PARK SCIENCE
A RESOURCE MANAGEMENT BULLETIN

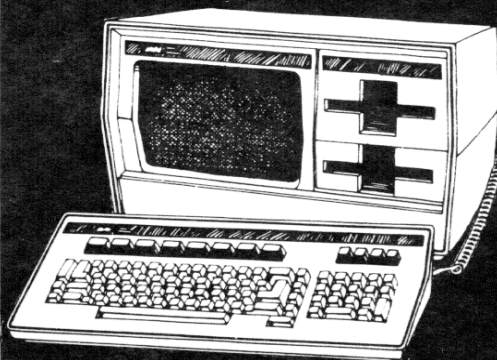Special Issue:
Information Management
and Natural Resources

PARK SCIENCE

NATIONAL PARK SERVICE

SPRING 1984

A report to park managers of recent and on-going research in parks with emphasis on its implications for planning and management

Elucidation Blues

With a plethora

Of words

The would-be

Explicator

Hides himself

Like a squid

In his own ink.

Conform

I want to be scene,

Not herd, said a wayward

Young springbok, as it split.

Know your place, said

The leader, which is together,

And clubbed the errant back,

Giving it the Gesellschaft.

This issue of *Park Science* is devoted to computers and parks. As guest editor, Anne Frondorf has done a Herculean job — collecting information from all corners of the National Park System on how the various areas are moving into the Computer Age.

What comes through on these pages is the over-arching principle of all systems: The System Self-Designs. There seems to be no other way. In spite of all the logic with which our linear minds tell us that these things should be planned and coordinated and orchestrated from above, the successful system stoutly refuses to grow that way. Instead, it begins in obscure corners and niches "all over the map" — adapting to a need here, an idea there — and then reaching out with tentative feelers for connections.

Computer technology and the uses to which it can and will be put had to arrive on the scene together. When that happened, the seed sprouted everywhere, like "emergent properties." Eventually, these filaments will interconnect more firmly and become, instead of many systems, *a* system.

As a new, systemic way of accomplishing planning and work, this system comes with the full complement of new perils and problems. One of these — the potential tyranny of the computer — is discussed by Celia Walker, who urges users not to take "NO" for an answer. (The old, frustrating deadend that used to read "It is our *policy* not to . . ." is being replaced by a new arbitrary negative: "The computer will not allow it." Walker warns: "Make sure it's the computer and not just some lazy human being.")

Information Crossfile offers additional cautionary computer notes, ranging from dead serious to hilarious.

But overall, the message on these pages is one of a powerful new tool, emerging in concert with the needs it is suited to handle. The idea is to inform, through this issue, every corner of the Park System about what every other corner is up to in the use of computers. Every item has a contact name and address. Rubbing minds together can make sparks; this issue should start a fire.

Guest Editorial

This special issue of *Park Science* is focusing on "Information Management and Natural Resources in the National Park Service." Our intent is to provide users — and potential users — of computers, word processors, and the entire spectrum of information management technology with a forum in which to exchange ideas and compare notes on the application of this technology to resource management and research issues.

Items describing current or anticipated information management activities relating generally to natural resource management and research are included from every Region and more than two dozen park units. Wherever possible, the name of a contact person has been given so interested readers can find out more about a particular type of equipment, program or software package, or application.

This is anything but a static field and it is important that we all continue to look for opportunities to communicate what we are doing or plan to do. Two such communication opportunities are described in this issue: the "Software Clearinghouse," being developed by the WASO Office of Information Management, and the Servicewide electronic "Bulletin Board System," accessible to anyone with a terminal and telecommunications capability.

In coordinating this special issue I have been tremendously impressed with the energy, enthusiasm, and initiative displayed throughout the Service on this topic. I am grateful to all who contributed to this issue, as well as to Jean Matthews for her efforts in bringing it all together.

> **Anne F. Frondorf**
> **Biological Resources Division, WASO**

Glossary:

Bit is one-eighth of a byte

Byte is a unit of data

8 bits equals one unit of data (a byte)

Baud means "bits per second" and indicates rate of transmission.

Resource Management Computer Applications: The Park System's Developing Response

Editor's Note: The grouping hereunder is a representative slice of the National Park System as individual parks have responded to the capabilities inherent in computer technology.

From Big Bend

The 730,000 acre Big Bend NP is one of the most remote National Parks in the contiguous United States. Located on the U.S./Mexican border in southwest Texas, the nearest grocery store is over 100 miles from park headquarters and the nearest town of any size is over 250 miles away. Spanish is a primary language, much of the park has no telephone service and many of the residences receive their only "outside" news from short-wave radio. Because of the park's resemblance to late 19th century Mexico, many people believe that information dissemination and management are restricted to the telegraph and pony express. This view perpetuates the "Goodbye God, I'm going to Big Bend" syndrome. Actually, behind the sleepy adobe facade there lives an active modern information management program that consists of three separate sub-programs: Telecommunication-dissemination; Community or recreational-assimilation; and Administrative-networking.

Administrative-Networking

In October 1982, the park purchased an ALTOS series 5 computer system. The multi-user system can run under either CP/M or MP/M II. The basic configuration includes five-megabyte hard disk drive, a 5¼ inch floppy disk drive, three Televideo terminal stations and a Diablo 630 printer. While the basic system is small, it has catapulted certain time consuming administrative tasks into microsecond technology. Rewriting operating programs (10-575's) once took hours; it can now be done in minutes, and recalculations can be completed in seconds.

The real time saving may be found in information sharing. A division stores its budget in the computer, which then can be accessed by administrative personnel who, with a few simple entries, can generate a status of funds or make administrative changes. In addition, the park uses the computer to generate billing, maintain vehicle mileages, information storage, filing, and general word-processing including lists, letters and mailings. The park already has outgrown the system and is investigating the possiblity of acquiring a larger Data General System which will be directly compatible with other park and regional office equipment. Once installed, the park system will be able to talk directly with those other systems — further increasing the efficiency and networking capabilities.

Telecommunication-dissemination

In 1982/83, telephone operations (which were in the Administrative Division) and the park radio system (which was in the Ranger Division) were combined into a Telecommunication Center operated by the Division of Interpretation and Visitor Services. The move streamlined the entire information flow in the park and consolidated it in a centrally-located position. The majority of information exchange deals directly with visitor services — telephone information requests, weather and road reports, etc. The Dispatchers, who are trained in both interpretation and law enforcement procedures, deal through a multi-channel radio system with Customs Patrol Officers stationed in the park and U.S. Border Patrol.

Community or Recreational-Assimilation

One of the major problems in an isolated area like Big Bend is the difficulty in receiving information from the "outside world." Lack of television and radio reception may be praised by some, but a person totally deprived of information in an information age probably is not going to possess a complete set of socio-communicative tools. A community may live without "60 Minutes," the "Superbowl," and "Hill Street Blues;" but can it compete socially or intellectually with communities that have access to a variety of media stimulants?

Residents of Panther Junction (park headquarters area) banded together to form a non-profit TV corporation. In 1983, the "club" signed an agreement with a cable company to install two large satellite receiving dishes and a residential cable system which, combined with an improved translator system, provides subscribers with a wide variety of FM radio and television programs including the Spanish International Network (SIN) for the 35-40 percent of the residents who speak Spanish. Two small residential areas in the park still have no TV or radio reception, but the club is working to have satellite receiving stations installed in those remote locations.

To the uneducated eye, Big Bend may represent the epitome of historic information management. But within the wilderness setting, there is a plan and a certain modern sophistication. Therein lies the paradox — Big Bend NP is a combination of 60 million year-old mountains, state of the art satellite receiving stations, vast expanses of wilderness, computers, old adobe buildings, microwave telecommunications — and people. People talking with people is the bottom line in information management.

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From Big South Fork

The Big South Fork National River and Recreation Area, a developing park unit on the Cumberland plateau, eventually will contain more than 100,000 acres. The area's resources are diverse and the related resource management data base is growing daily. The staff realized early in 1983 the need to develop an automated data base and to procure computer hardware and software as early as possible to prevent future storage, retrieval, and analysis problems. Networking possibilities also were considered.

The first computer equipment was purchased in Spring 1983, with the main hardware components including an IBM-PC microcomputer with two disk drives, an AMDEK monitor, an NEC letter quality daisy wheel printer, a Hayes Smartmodem, and an Orange electronic protection device. Software purchased included dBase II, MultiPlan, Wordstar (with Mailmerge), and Crosstalk. In Summer 1983, a Corvus 10 MB hard disk system was purchased in anticipation of large data base. Originally, a one-computer system was believed to be adequate for parkwide use by all divisions. We planned for dBase II to be used for all inventory/data base work, Wordstar for word processing, MultiPlan for budget work, and Crosstalk for networking (particularly for electronic mailing and to tap other information systems). However, it was soon realized that one terminal would not be sufficient for use by all park staff.

In Spring 1983, $125,000 in PRIP (Significant Resource Problem) monies was approved for work relating to mineral developments and associated water quality problems. Computerizing the data base was the only logical approach to managing these problems effectively given staffing constraints, so we designated a large portion of these monies for development of a Geographic Information System (GIS) using an IBM-PC and dBase II.

Major hardware purchased for this GIS system included an IBM-PC with two disk drives, an EPSON FX-100 dot matrix printer, a Corvus 20MB hard disk with mirror, an HP 7470A plotter, a GTCO "DigiPad 5" digitizing pad, and an IBM color display monitor. We have a contract with the University of Tennessee Space Institute (UTSI) in Tullahoma, Tenn., to develop this GIS system. UTSI already had developed a mapping/data base system for vegetative types in the Recreation Area under a previous contract and will add 20-30 "themes" (e.g., roads/trails, water areas, endangered species sightings) to their existing system. The development of software to allow for various analyses and revisions of data also is a part of their contract. This system is to be ready by September 1984.

As we await the final GIS system, we continue to work with our first IBM-PC system. Currently we are preparing an oil and gas well data base using dBase II and compiling water quality sampling data using MultiPlan. Wordstar is being used for plan preparation and daily correspondence. Crosstalk soon will be used to tap other park and agency information systems and for electronic mailing. Once administration begins using MultiPlan extensively for budgeting, Resource Management will be able to make accurate budget adjustments as needed. Also planned are the hiring of a computer clerk and a proposal to acquire an IBM-PC system for the Obed Wild and Scenic River — another park area administered by the Big South Fork NRRA Headquarters.

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From Biscayne NP

The Park's Hewlett-Packard 9825T computer with 68K user available RAM memory was purchased by the Southeast Region in 1979 as part of a Hydrolab water quality monitoring system and was updated in 1982. This computer is used to edit, compute values and store bay and reef tract water quality data. In 1984 it will be used for statistical analysis of the 10 year bay water quality data base.

The Hewlett-Packard computer also is used to compute and store monthly visitor use data and produce yearly cumulative totals. Other uses include storing addresses, printing mailing labels for public service announcements, programs to list and locate dive equipment, training and program needs, and dive logs for park divers.

Currently our sport and commercial fishing creel survey data base, begun in 1976, is stored on the Wang computer at Everglades NP (EVER) South Florida Research Center, where weekly, quarterly

The Park System's Developing Response, cont'd.

and yearly statistical analysis of recreational and commercial fishing is done. Analysis of the first five year data base is in progress.

The Park purchased an IBM Personal Computer (PC) with 640K memory in September 1983. Initially, communication with the EVER computer to store fisheries data is planned to save time spent in transportation of personnel to and from the Wang. Eventually, this data base may be transferred to the IBM-PC. Due to increased memory capability of the IBM-PC, the water quality data base stored on the Hewlett-Packard computer may be transferred to the IBM-PC. Storage of exotic plant control data is planned to summarize work reports, evaluate herbicide efficacy, and schedule follow-up treatment.

We hope to develop a multi-dimensional data base information retrieval system which would catalog and make retrievable all information, utilizing a coordinate base grid system developed in such a way that data could be input and verified by the user on an individual data point, data set, or subset basis. This system is particularly attractive since all data bases would not have to be placed on the computer at one time. The result would be that different types of data or data sets could be compared or evaluated separately. Access to other agency data bases also may be possible.

Other park uses of the IBM-PC include programs for tracking park administration inventory, personnel, budgets and training needs, Ranger case incident reports and as an aid in interpretive program planning and statistics.

Past problems with the park computer include lack of interest and fear of the computer, lack of knowledge of computer capabilities, inability to use or program the computer, and the press of other critical duties on personnel with computer knowledge. Training of all personnel who will directly or indirectly be affected by computer capabilities and use is needed. The park needs employees hired specifically to schedule computer use, determine and define needs, write programs, put data on the computer, and train in-house employees on capability and use.

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From Blue Ridge Parkway

In October, 1982, the Blue Ridge Parkway took delivery of three Vector Graphic Model 4-30 microcomputers. Each unit included the CP/M operating system, an integrated software package (database, spreadsheet, word processing, graphics, and communications), a printer with graphics capability, a modem for telecommunications, and 5 megabytes of hard disk storage. The Parkway already had several Apple II Plus computers running the MOSS (Maintenance Operations Scheduling System) program.

Prior to acquiring the hardware and software, Supt. Gary Everhardt established an inter-divisional committee to examine Parkway information needs, inventory computer applications, and survey software and hardware configurations. During 1983, several applications were up and running with excellent results in the area of protection (incident records) and accident files, safety, electronic mail, word-processing, personnel records, training inventories, property management, monthly and annual interpretation and visitor services reports, budget, and volunteer hours and costs. In addition experimentation was conducted with direct visitor information access programs.

Blue Ridge Parkway is exploring several applications in resources management. RM Spec. Larry Freeman is working on a database file to store information from the Parkway's 400-plus special use permits and letters of agreement related to agricultural use, including names of landowners, fence lines, acreage in pasture, hay, crops, etc. The program will automatically compute any fees involved.

The agricultural use file is just one example of a database application which is essentially an electronic file system with a surprising degree of sophistication. Other applications the Parkway intends to explore include an endangered plants inventory, acid rain observation file, stream analysis, vista burning program, bear management, forest disease data, fisheries, exotic plant control, hunter parking permits, etc. The Parkway's incident file (a database consisting of information from Case Incident Records, Form 10-343) is being modified by developing a series of incident codes specific to resource management activities.

One application useful in all functional areas is word processing. Recently the Parkway re-wrote its Resource Management Plan and accomplished the task in a third of the time it would have taken to manually draft and edit. Corrections, additions, and revisions can be inserted easily into the original to reflect future program changes.

Frequently, the Parkway staff finds computerized data useful in ways not originally anticipated. For example, a recent resources management project on the Parkway was interested in data related to motor vehicle accidents involving whitetail deer. The computerized motor vehicle accident file was examined and valuable information quickly retrieved. Two examples of this type of information are illustrated in Figures 1 and 2. Figure 1 is a bar graph showing the number of deer-related motor vehicle accidents by District. Figure 2 shows the percentage of deer re-
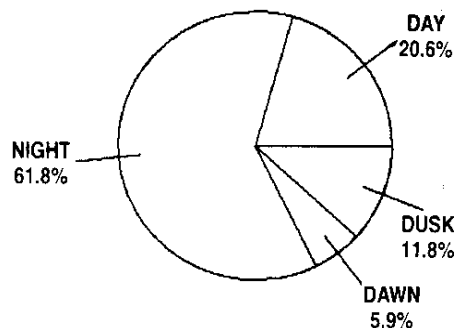

Figure 2
Deer Caused Motor Vehicle Accidents
**Light Conditions—1983**

lated accidents occurring during different light conditions. These examples were generated in a matter of minutes using the Vector Graphic's plotting routines automatically accessed by the database program.

Another example of micro-computer applications is the use of telecommunications software and a modem to access scientific databases over telephone lines. The potential related to literature searches, abstracts, etc. is just beginning to be realized by park personnel. Some of these databases are surprisingly cheap compared to alternative acquisition methods.

Much of the Park's work in 1984 is evaluating the feasibility of microcomputer applications in resources management. The staff has learned that although certain types of data and information can be kept on a microcomputer, it is sometimes easier and more efficient to continue the task manually. Whether it is practical to computerize depends to a large extent on the volume of data and the need for selective or sorted retrieval.

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FIGURE 1
Deer Related Motor Vehicle Accidents By District—1983
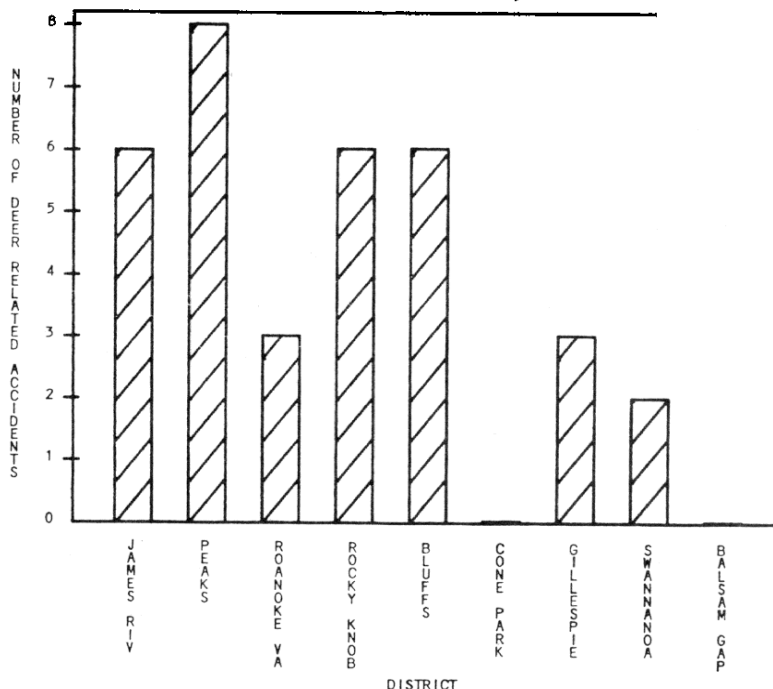
The Park System's Developing Response, cont'd.

From Canaveral National Seashore

Canaveral began its in-house use of an IBM-PC nearly two years ago. A single unit was purchased; this was complemented by two other employee-purchased IBM-PCs. Basic work has been accomplished in word processing, spread sheets and data accumulation, along with electronic mail.

Following are the computer programs, listed by the software or language used, together with the tasks they perform.

Basic Language
A monthly tide table calculated for the Canaveral beaches.

A mailing list to produce mailing labels for various park interest groups.

Word Processing (Word Star)
Draft and finalize Resource Management Plan and Interpretive Prospectus.

Biweekly staff meetings and park in-house newspaper.

VisiCalc
Spread sheet for monthly expenditures and programming for fiscal year.

dBase II
Inventory control on radio communication system.

Personnel data information.

Incident data accumulation for L/E Management decisions.

Profile on vehicle B & Es.

Mosquito quantity and species for pesticide justification.

Data base production for time utilization.

X Talk
Retrieving fire weather forecasts and submission of fire information.

Submission and receiving of information from SERO.

One interesting devised program is the development of a profile for breaking and entering a vehicle. The experiment is beginning to produce factors that indicate the most probable location, time, month, etc. that an incident will take place. All stable conditions were considered for the data, including temperature, day of the week, cloud cover, month, cars in parking lot, holiday, etc. A total of 31 various data elements was entered for each incident. A form was designed for gathering these data as a supplement to the normal reporting requirements, simple and easy to make out. It takes about 30 seconds to enter each sheet of information into the computer. It is hoped that the data will help us select areas and time of patrol to decrease this activity.

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From Crater Lake

Monitoring the production, distribution and usage of water supplies throughout Crater Lake NP has recently been improved by the development of a computer model. The Water System Model was developed on the Park's Datapoint 1800 computer utilizing MULTIPLAN, a spreadsheet program that facilitates tabulation of numeric data. The program provides for the entry of metered production and usage values on a monthly basis and automatically calculates unmetered figures based on distribution to various park and concession operated areas.

Through its capability of automatically adjusting dependent values, the Water System Model also provides a means of analyzing pumping requirements or forecasting conservation needs.

The Crater Lake Limnology research program collects approximately 400 pieces of data per week in the basic monitoring schedule. When this is combined with USGS gaging information and data from special investigations into nutrient chemistry, atmospheric inputs and ground water discharge, the data volume becomes unmanageable by conventional means. Since the program is mandated by PL-97-250 for a period of 10 years, the park quickly recognized that computerized storage, retrieval and manipulation of the information was a necessity for accurate determination of trends in Crater Lake's water quality. Utilizing park base funding and SRP funding for Lake Research, the park has:

1.) Purchased a 256KB, 10MB hard disk Wang Professional Computer with associated statistics, programming, communications and graphics software;
2.) Begun the development of telecommunications connections to the Oregon State University main frame computer for large data base manipulations; and
3.) Begun working with the CPSU at OSU to develop a water quality data program for the Wang that will allow input directly from the park of data that are compatible with the OSU main frame statistical analysis packages.

Additional uses of the Wang PC include a Crater Lake research bibliography, a program for prescribed fire fuel loading calculations, and word processing for Resource Management/Backcountry operations.

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From Glacier NP

Since August 1982, Glacier National Park (GNP) has maintained an interagency agreement with Flathead National Forest to develop a digital geographic information system (GIS). Impetus behind the agreement has stemmed from regional interagency cooperation and expertise within both agencies for developing automated information systems. Benefits include the ability to address shared resource problems that are regional in scope, a standardized technical jargon and methodology, increased interagency communication, and opportunities for reduced cost. The GIS will be relevant to about 8,000 mi^2 (20,000 km^2) within northwestern Montana. It will not only inventory and monitor resources, but also analyze data. User options will exist to merge two or more data planes to formulate higher, more complex levels of information.

The project goal is to implement an operational "in-house" system that addresses a broad spectrum of resource and research issues. Such a generalized approach permits maximum flexibility and requires many independent data bases. Data bases completed for the entire project area include two Landsat land cover classifications (dating from 1979 and 1981), elevation, slope, aspect, political boundaries, and subdrainage boundaries. For about 35 percent of the project area, data bases are complete for: roads, trails, logging activities, streams, lakes, islands, and an ecological land type classification developed by the Forest Service. Additional data will be added in the near future including precipitation, lightning ignition, forest age classes, fire history, forest disease sites, wildlife winter range, land ownership, and other land use types or facilities.

Washington State University is assisting the project, providing computer hardware and software support. Digital files are created in rastor/image format for each data base — a process that usually requires prerequisite steps such as map drafting, digitizing, and vector file generation. The files are then registered to a UTM (Universal Transverse Mercator) coordinate base. Most functions are accomplished within the scope of image processing using batch VICAR/IBIS and interactive I^{2}S system 575 software. A Numonics series 2400 digitizing tablet is used to generate the vector map files.

Once operational, the data base will reside with Flathead National Forest and/or GNP. A need will continue, however, for mainframe computer assistance when old data files are updated and when new files are created. The capability will exist to display and analyze subsets of the data on image processing hardware planned for in-house purchase. Thus, the system should be readily available for local resource managers and field personnel.

Data base compatibility, development by field personnel, and proximity to field operations are important factors determining an information system's success.

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From Grand Canyon

Grand Canyon NP has a Datapoint 1800 microprocessor with 120K of user memory, 10MB hard disk, printer, and two floppy disk drives. The park's River Subdistrict has both a teleprinter and an 8200 Datapoint terminal, which is currently linked to the USGS DEC PDP-11 system in Flagstaff. The park also has had a centralized word processing system for several years.

The park recently acquired two IBM PC's (with most of the optional bells and whistles) for the Resources Management Division. The plan is to develop several data bases pertinent to cave inventories, backcountry use/impacts, research permit issues, cultural resource inventories, ad almost infinitum, using the data base management system dBaseII. There is also the potential for a third IBM PC in the park, assigned to the Maintenance Division, for in-house applications as well as remote access to large maintenance-related data bases currently maintained at Boeing Computer Services.

We're currently struggling with our most comprehensive software/hardware proposal to date: automating our backcountry reservation and permit system. Our average number of permits issued per year is currently 14,000 totalling more than 84,000 user nights and encompassing an advance reservation period of 15 months. It's a tough proposal because the resultant system must be the most "user friendly" available (due to the number of temporary seasonal staff that will use it) and virtually fail-safe (we already have fist fights in the permit waiting lines, can you imagine what would happen if we had to say our com-

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The Park System's Developing Response, cont'd.

puter system went down?)

What we feel we need in a data base managment system and the extent and type of files access suggests a hardware configuration beyond IBM PC/ Apple/etc. options, but the jury is still out. We also want to assume responsibility for our own backcountry use statistical analyses, currently performed for us by the University of Washington CPSU on a monthly, quarterly, and annual basis.

Finally, we derive several positive benefits from our mutual agreement with the USGS Computer Branch in Flagstaff. While our time-sharing on their DEC PDP-11 system (for river use statistical analyses is not cheap, we derive the benefits of top-notch expertise and sincere interest in the park's natural resources from the USGS ADP staff. Having their facility within driving distance has provided technical assistance at little or no cost upon occasion. And there is just no substitute for their level of ADP capability/ knowledge when you're living on limited money.

Pat Phelan
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From Great Smoky Mountains NP

The Resources Management Division of Great Smoky Mountains NP recently acquired an IBM-PC unit. Accessory equipment inclludes a Haynes Smartmodem Model 1200, Epson Printer FX-100, two floppy disc drives on the system unit, one expansion unit (10-megabyte hard disc drive), IBM Monochrome display, Grizzly power source, and a quad link board. Software support for the system includes Lotus 1,2,3, Wordstar, dBase, Apple-IBM connection, ProKey, a Random House Proofreader, and Crosstalk.

Current uses are for standard budget and FTE tracking programs and word processing. A sidelight of the budget program is the generation of a capital and non-capital property listing for inventory and control purposes. This separate listing is done when a requisition is entered against an account by expanding the fields to include property quantity and description. Inventory programs also are in use, or proposed, for better accountability of wildlife immobilization drugs, training records, wildlife law enforcement and observation records, and for tools and equipment.

A future project that promises a useful data base for recreational fishery management and brook trout restoration efforts is the cataloging of all park streams, location, order, species contained, elevational limits, tributaries, country, and state. A link between the Division's IBM-PC and a mainframe IBM unit at the University of Tennessee via the Smartmodem will allow for analysis of data obtained in creel and fish population surveys utilizing the SAS program.

The IBM currently generates 150-175 "reminder" letters to potential park firefighters that it is time to update step tests. The park retests twice annually because of spring and fall fire seasons. The memorandum generated also provides the prospective firefighter with his last step test score and date passed. Future efforts will include AFFIRMS network interface on the IBM, red card records, and fire history and record storage. A modified U.S. Forest Service hazard tree identification decision key is being experimented with for possible application in the park.

Storage and data manipulation have proved worthwhile in managing bear relocations, mast surveys, bear indices, exotic wild hog removal effectiveness, and temporal and spatial analysis of wildlife incidents. A hog population model has abeen obtained (for an IBM-PC) and will be tested this year.

Last, a resource management plan project statement tracking system that interfaces with resource management collecting and research activities is under construction. The program will display a brief abstract of the project, and the three principal actions of research, monitoring, and resource management concerning that project. In addition, *all* collecting and research activities concerning that project may be tracked and vice versa.

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From Hawaii Volcanoes

The Resources Management Division of Hawaii Volcanoes NP recently acquired an IBM-PC. Using software, such as Ashton-Tate's *dBase II,* Lotus Development Corporation's Lotus *1,2,3* and Software System's *Multimate,* the PC has become a useful tool in analyzing field data in feral animal control, exotic plant control, and nene (Hawaiian goose) restoration programs. The PC also is being used in many administrative functions.

The database management system is ideal for data storage and retrieval. Lotus *1,2,3* analysis and graphing functions allow data to be presented in many ways and can provide the manager quickly, with numerous options, greatly enhancing decision-making. Technical papers, as well as coorespondence, are handled by the word processing software.

Specific applications so far include entering field observations and vital statistics in the endangreed Hawaiin goose (nene) restoration program, treatment data in the exotic plant control program, property inventory, livestock and hunting dog vital statistics and history, and budgetary records. The Research Scientist is using a feral pig population model developed by Dr. Reginald Barrett in evaluating research progress in feral pig control methods. Although the system has been in the park for less than a year, already it has proven a valuable asset to Resources Management and Research.

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From Indiana Dunes

The Science Division of Indiana Dunes NL has developed a computer system that enables us to do a wide variety of data analysis tasks with ease. The hardware consists of a Datapoint 8200 CRT terminal, a Datapoint 9621 serial dot (132 column width) matrix printer, an IBM PC with an Asynchronous Communications Card, and several modems. We hope to acquire a letter quality printer so the PC can be used for word processing and letter typing. Our piecemeal acquisition of the total system resulted in some difficulties.

Using the Datapoint terminal through a modem phone line we can hook up to the Boeing Computer

Services (BCS) office in Chicago and access their mainframe IBM 370 computer at Vienna, Va. They possess the Time Sharing Option (TSO) which enables us to keypunch data sets directly into computer files on disk. BCS also maintains several statistical software system packages that allow us to perform many kinds of analysis. Additional programs can be added to the files as needed. We are also able to print quickly the results of any data analysis.

One difficulty is that once data sets are deleted from TSO, there only are two very time consuming options for recreating the data sets; 1) if the data are on cards they have to be reread through a card reader or 2) the data can be re-entered by hand on the CRT terminal. Of course it costs to keep data sets in TSO files even when you are not using them; if you have over 50 files, it can be quite expensive.

The IBM PC solves these problems. Through the asynchronous card and modem phone line it is possible to communicate directly with the BCS computer. Consequently, data sets can be created and stored on PC floppy diskettes and through the above mentioned setup it is possible to recreate data set files on TSO within minutes. Other advantages include never using computer cards, storing data sets in a compact form and most importantly, saving computer costs.

Glitches on the phone line caused by poor connections can be a problem. Another problem is the requirement for a special cable so that the IBM PC can be connected to our high speed printer. A printer should be purchased with the terminal. Otherwise, output must be printed at a BCS office and mailed to you. Much time can elapse before discovering you made a Job Control Language or syntax error in your program, especially when the operator is unfamiliar with the software.

Application of the system has involved the analysis of large complex data sets generated from research and applied towards solution of resource management problems. Examples include the analysis of environmental data from road salt on impacted and unimpacted portions of Pinhook Bog, analysis of vegetation data to understand the successional processes in razed residential sites, the classification of vegetation to develop a vegetation map of dewatered pond beds, and the study of plant community patterns in prairie ecosystems.

We also have used the IBM PC to store herbarium data and information concerning the occurrence of rare plants. Resource management has written a program to fill out scientific literature request forms from the Interior Department library. Other resource management applications include storing and analyzing road kill statistics, deer fat data, fire weather information and eventually, effects of controlled burns on small mammal populations.

In the future, we hope to add a color graphic terminal, increase the storage capabilities of our PC, and purchase additional terminals. Thus, the combination of a printer, a terminal, and a personal computer that can be linked to Boeing Computer Services enables data to be stored and analyzed in an efficient and inexpensive manner. With such capabilities, almost any analysis problem is solvable.

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From Isle Royale

Initially purchased for administrative and payroll applications, Isle Royale's Datapoint 8620 Computer system is now being used for resources management applications as well. Located in the middle of Lake Superior, Isle Royale does not have direct telephone access to the main computer, which is located in Houghton, Mich. A terminal is hooked into the processer via a 1200 baud modem and radio telephone to run applications programs. The same terminal is also used as a "dumb tube" along with a matrix printer to connect with the AFFIRMS fire weather computer system.

The Datapoint system is largely business oriented, so software for resources management and scientific applications is practically nonexistent — particularly programs dealing with statistical analysis. Use of existing software largely focuses around Datapoint's Integrated Electronic Office System or Word Processer, whose benefits are obvious in the development and updating of resources management plans and reports. For example, Isle Royale now has a complete Park Bibliography, easily updated, of over 750 references which can be queried by key word or word combinations such as author or subject(s). This application has been particularly useful in responding to requests for specific information by the public or the research community.

Development of in-house computer programs at Isle Royale for resources management applications is in the beginning stages. Initial efforts are geared towards the analysis of visitor use data collected from the Backcountry and SCUBA diving permits. For example, a summary list of the number of dives made on each of the 30 shipwrecks and historic sites is being used to make decisions on the placement of mooring buoys to protect these significant cultural resources. Because of the time consuming nature of writing software, a "program to write programs" called DATAFAST is used to build the data entry portions of all programs.

Envisioned for the future are programs to develop data bases and do analysis on meteorological conditions, backcountry campsite conditions, and colonial bird rookeries.

Craig C. Axtell
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From North Cascades

Wildlife observations reported by employees and visitors provide valuable information on the distribution and relative density of various species, thus supplementing field studies by the park biological staff. Data are recorded on Natural History Field Observation cards (Form 10-257). Despite North Cascades NP Service Complex's relatively short existence (since late 1968), already we have accumulated several thousand completed cards. These are distributed among 48 mammal, 155 bird, 7 reptile, 7 amphibian, and 9 fish species.

Natural History Field Observation cards are stored alphabetically by species and class in file cabinets at North Cascades park complex headquarters. Although this data-storage system is adequate for retrieval by species or class, cross-referencing by other variables such as location and habitat-type is not possible.

A strong need for a multi-variate wildlife data-retrieval system became apparent both from internal park-management needs and from numerous requests by universities, corporations, and private individuals. The recent acquisition of two Datapoint computers and a programmer (Robert Borreu) facilitated development of a new system.

The new system permits retrieval by species, class, county, topographic quadrangle map, Universal Transverse Mercator coordinates, elevation, precision (confirmed or unconfirmed), date, and observer. Figure 1 shows an example of the printout. For most variables, ranges of values also can be selected. Although few habitat data can be directly retrieved from the cards, approximations are possible. For example, most observations in old-growth western hemlock — western red cedar forests could be retrieved by selecting elevations below 1200 meters and Universal Transverse Mercator coordinates less than 650000E. It may be possible to more directly document habitat-type in 1984, when vegetation mapping for the park complex is completed.

Presently this system contains information on 12 mammal and 22 bird species that are endangered, rare, or unusual in our area. We do not anticipate putting data on the more common species in the computer in the near future.

Printouts can readily be sent by mail in response to requests originating outside the park complex.

This new use of the computer has dramatically improved retrieval of data on wildlife distribution and relative density in the North Cascades park complex, and could serve as a model for systems in other park service areas.

Jonathan Björklund
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Figure 1. Example of computer printout of wildlife-observation data.

From Olympic NP

Equipment: Datapoint 1560 w/10MB hard disk — DOS H. Will run "standalone" or under ARC.

Programs and Software: Multiplan, Datascan, FORTRAN, IEOS, word processing, CP/M-80 2.2 (in progress), Lemonade, DATABUS*

In the Olympic S&T Division we are using the computer primarily as a data storage and manipulation tool. Current applications include analysis of permanent plots in plant communities, manipulation of anadromous fish spawning survey data, hazardous tree records, hazardous tree monitoring, statistical analyses, budget tracking, wildlife management, drug inventories, equipment inventories, and word processing. We expect to use the computer for plant checklists, herbarium inventory, museum catalogs, wildlife observation cards, bibliographies, scientific abstracts, fish scale data, wildlife movements, electronic mail, storage of weather data, fire management and as many other applications as our collective imaginations will allow.

The first park computer was a Datapoint 1800 with a 10MB hard disk drive we all shared. Since data storage and machine access were too limited we added a 1560 in the Science and Technology Division and two 1560s running under the ARC system in Administration. The 1800 currently is in Maintenance and plans are underway to add a 1560 in the Interpretive Division. Most of us are pleased with the Datapoint system but we continue to study alternatives.

Initial use of our computer system was relatively slow. Each individual had to become familiar with new equipment and — in some cases — with computers in general. We have had a computer for approximately 16 months and still feel we are in the embyronic stages of how best to use the system. It is apparent we need at least one and more likely two programmer/operators on a full-time basis.

To take full advantage of a computer system, considerable time must be spent on training. Staff members need to know both how to use the computer and how to determine what types of applications are ap-

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*Bits per second (indicates rate of transmisson)

The Park System's Developing Response, cont'd.

propriate for computer use. Tasks that are to be handled by the computer must be carefully thought out. It is inefficient as well as frustrating to a programmer to have someone continually changing or adding parameters to a program that has already been written.

At Olympic we are committed to broad applications of the system. As more of our experts on particular subjects become familiar with the computer as a "working tool," we find we are just beginning to tap the advantages of ADP.

*Software package descriptions:

DATASCAN — a data base manipulation tool of considerable power, but operates slowly on some machines.

LEMONADE — a screen generator, allows set up of a "page" on the screen so that when data is entered it is automatically placed in a predetermined format.

IEOS — Datapoint's word processor.

DATABUS — a computer language designed by Datapoint.

FORTRAN — a computer language designed for scientific applications.

CP/M 80 — an operating system used by many processors including IBM, Kaypro, etc.

MULTIPLAN — a powerful "spread sheet" set up in rows and columns. Appropriate for smaller data sets and making tables or maintaining running totals in different accounts.

DOS H — the disk operating system on Olympic's Datapoint 1560 series computers.

Ed Schreiner
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From Redwood NP

In the summer of 1983, Redwood NP's Technical Services and Resource Management Divisions bought their first computer hardware for use in the Arcata, Calif. office. This system is used for accessing the Humboldt State University CYBER 170-720(2) mainframe, also located in Arcata. The University is authorized to provide computer processing services to agencies of the U.S. Government on a full cost recovery basis. This is a particularly attractive arrangement for the park because of the power and speed of this computer and the large amount of software. Both are serviced and maintained by the University, enabling us to concentrate on data input, analysis, and program development.

For our first system, a stand alone microcomputer was unnecessary, due to our ability to access the University CYBER. Our hardware consists of a Digital Equipment Corporation VT-100 terminal and LA-100 printer and a 1200 baud Racal-Vadic modem for both the park office and the University to establish a communication line. The terminal has the advanced video option, useful for scanning output from "canned" statistical packages. A Digital Engineering GENII Retro-Graphics board in the terminal gives us the ability to display graphics on the terminal screen.

We are acquiring a Tektronix graphic system capable of locally running the SAGIS resource management mapping software (reviewed in Winter 82 and Winter 83 PARK SCIENCE). Our needs for such a

system are based on (1) our current inability to extrapolate results obtained in statistical analyses to generate schematic portrayals of numeric trends and to generate secondary data for input in statistical computations; and (2) our need for a large capacity graphics system that can reduce to usable form map base data from the first five years of our watershed rehab program.

Our "canned" software gives us flexible, powerful tools that provide analysis of simple univariate or complex multivariate data by researchers with no previous experience of considerable expertise. In addition, a number of programming languages are available for use when a task cannot be handled by conventional canned software.

Two larger FORTRAN programs, SYNTAB, and RD2BED, written by the author, may have applications in other parks. SYNTAB is an interactive program that will produce a synthesis table for ranking or classifying data that have been recorded in the traditional ZM style, into discrete plant communities, called associations. RD2BED is an interactive menu driven program that will produce the contract specs that enable heavy equipment operators to bid on such jobs as putting a road to bed as part of our program to prevent significant sediment sources from entering the mainstem of Redwood Creek. The Geologists/Hydrologists COTR determines which of five techniques to use for returning the hillslope to its pre-road profile, enters the data as the program prompts, and puts out the contract specifications.

Currently the Divisions of Resources Management and Technical Services are jointly funding a half-time (temporary) computing consultant position, the duties of which include: (1) liaison with the Humboldt State University Computer Center; (2) training staff in the use of specific application programs and utilities; (3) writing programs for applications not available in canned software; (4) standardizing and archiving existing data; and (5) trouble shooting hardware and software problems. Benefiting projects provide for their own data entry and analysis utilizing existing personnel.

Mark Schroeder, our wildlife biologist, has collected a large data base that focuses on the ecology of the black bear in Redwood NP. The largest set consists of relocation data for the monitoring of habitat use by bears throughout the mosaic of cutover lands in the expanded portion of the park. Each relocation of a radio-instrumented animal is coded into UTM grid coordinates. This generates hundreds of relocation points. When analyzing these data for associations with habitat type, topography/landforms, climate, and possibly other instrumented bears, computers greatly simplify the work. Available software also can prepare tables, graphs, and maps. The information is easily stored and can be retrieved for reuse in similar wildlife studies. This data base also includes information on food habits, hematology and blood chemistry, somatic measurements, and condition evaluation. Schroeder expects the new technology to aid in interpretation of the various parameters and to enhance his contribution to wildlife research management.

William S. Lennox
Redwood National Park
Crescent City, CA 95531

From Rocky Mountain National Park

Rocky Mountain NP is upgrading its Datapoint system to the Model 8640. An agreement was made with the consulting firm of Arthur Anderson and Company of Denver (through the Super VIP program) to thoroughly evaluate the park needs. We are now in the process of looking at the various ongoing research and monitoring programs including wildlife population studies, range conditions and trend monitoring and vegetation studies as the first priority for data processing. In the future we see the addition of a basic data file, research project register, science library catalog, herbarium file and wildlife observation files. We would be interested in what other programs have been developed throughout the NPS for the Datapoint system. Being able to utilize what already has been developed would certainly accelerate our program.

Owning your own personal computer may offer a researcher a continuity in data analysis that is impossible when using larger computers. As research professionals we don't think twice about purchasing books or joining professional societies. In time, the ownership of a personal computer may be just as common a "tool of the trade." It's difficult to be enthusiastic about writing a substantial software library if you know that when you are transferred the software probably will not be compatible with the computer at your new location. Also, data sets may require an extensive overhaul to meet the input format of the new analytical software. By owning your own, or at least sticking to an industry standard, such as "IBM compatible," these problems are eliminated.

NPS researchers should begin sharing their experience with computing systems. Communication via telephone lines will permit the sharing of nonproprietary software. Data sets could be transmitted for analysis by others who may have more apropriate software. Calculations could be performed by personal computer; the results could then be transmitted to a facility with higher quality output facilities, such as a plotter or color printer.

The time seems right for the use of small computing systems for research, and for coordinating that use on a wide scale. In particular, researchers will need assistance in interfacing personal computers with mainframe systems and their associated facilities. In most cases this will consist of little more than establishing an account at the target facility and using the personal computer as a very intelligent terminal.

Dave Stevens
Rocky Mountain NP
Estes Park, CO 80517

From Sequoia and Kings Canyon

The "old veterans" of Sequoia and Kings Canyon's growing array of data processing equipment are a Datapoint 1550 operated by the Division of Resources Management, and an IBM PC in Research: . . . both are scarcely one year old.

The Datapoint is a word processing workhorse, providing electromagnetic storage and convenient updating of plans, such as the Natural Resources Management Plan, Bear Management Plan, Fire Management Plan, and others that require extensive amendment in draft and annual revisions. This word

The Park System's Developing Response, cont'd.

processing capability has eased greatly what had become a fearsome secretarial bottleneck.

Thanks to his previous programming experience, Fish and Wildlife Specialist Harold Werner has developed local programs in BASIC and FORTRAN to manage an extensive water quality data base that permits non-expert users to access and enter data. A combination of commercial and local programs is similarly under development for a bear management data base. Although the Datapoint clearly has been an advantage, its limited memory and available software will tend to cramp new uses in the future.

Research operates an IBM PC that is used, at present, for data analysis, data base management, and word processing. The hardware continues to evolve, but presently is configured with 576 KB RAM, 2 DS DD floppy drives, an IBM monochrome monitor with a Hercules graphics card, a dot-matrix printer, and letter-quality printer on order. We rely extensively on RAM (psuedo) disk software to reduce the read/write time that comes with floppy disks.

The IBM is used for a large variety of tasks by the research scientists, technicians, and clerk-typists. An on-going acid rain research project generates a number of extensive data sets on water chemistry, meteorology downloaded directly from automated weather stations, vegetation, and a bibliography. Commercial data-base management, statistical analysis/graphics, and word processing programs are used extensively for data input, analysis, and editing/formatting tasks. Local programming to date has been in interpreted BASIC, but a FORTRAN compiler is available to exploit the many resources programs in that language, and we are exploring the use of "C."

In terms of console time, both computers are heavily loaded. In future we may consider a multi-user operating environment with additional terminals. This would require a hard disk to handle the additional storage requirements and to speed read/write times.

In FY 1985 Sequoia and Kings Canyon will embark upon a long-term geo-based resource information system including the extensive collection and storage of many large inter-related data sets. This almost certainly will require addressable memory and processing speed beyond the capability of the IBM PC. We are considering for this task a "high-end" microcomputer with large virtual memory capable of supporting a multi-user environment, and hard disk.

One thing I've discovered that appears to have been true for all the computers (now numbering 8) in these parks: There seems to be a several-months lag period before users become comfortable with the machines and have refined their thinking to where the machines are transformed from expensive playthings to useful tools. Once that point is reached, however, utility seems to grow in almost a logarithmic fashion; so does use, as more people see the computer in action and want to become involved. Then comes a scramble for keyboard time . . .

These parks recently implemented a Computer Management Committee to promote the most efficient use of equipment and software presently owned, and to provide systematic planning for the future.

David M. Graber
Sequoia/Kings Canyon NP's
Three Rivers, CA 93271

From Whiskeytown NRA

At Whiskeytown NRA, the Datapoint 1800 computer system has been in operation for about one year and is used by all divisions. Whiskeytown does not employ any programmers so the capabilities of the 1800 for the most part, have been governed by available software. The computer is used for payroll functions (DIPS, PAYPERS), budgeting (MULTIPLAN), GSA vehicle tracking, law enforcement visitor use statistics and case incident statistics, and word processing for repetitive correspondence and modifications in the park fire management plan.

Each division sees additional tasks which could use a computer's storage and processing agility. An inventory and maintenance record of buildings, signs, and equipment would facilitate planning of cyclic upkeep. The inventory of the Natural History Association's materials could be updated constantly by a computer cash register system for the visitor center; a sensitive screen, user-friendly informational terminal would benefit the park visitor. Law enforcement personnel could provide readily available intrapark communication regarding vandals who habitually strike national parks. (One sensitive aspect is the problem of adequate security to prevent access to confidential information.)

For managers concerned with mineral leasing, a software program capable of providing a cross-indexed listing of land characteristics by township, range and section would be useful. The computer, by telephone modem, also could give access to the AFFIRMS fire weather system, and to the lightning fire prediction program (LLAFFS) provided by the U.S. Forest Service. Ideally, graphics capabilities would be of great help in mapping of vegetation types, soil types, backcountry trail system, etc. Electronic mail would allow quick, intrapark correspondence.

Victoria Mendiola
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From Wind Caves

The Administrative and Forest Fire Information Retrieval and Management System (AFFIRMS) is a user-oriented interactive computer program designed to permit simultaneous entry of fire weather observations from field stations over an extensive network. Fire weather data may be entered from any of a number of data terminals; then those data and the associated fire indexes may be centrally archived and may be displayed at any terminal in the network.

Wind Caves is one of the first parks outside the PNR to use AFFIRMS from a Datapoint Computer. AFFIRMS uses the 1978 National Fire Danger Rating System as a basis for calculating fire danger indexes, which in turn provide fire managers with an invaluable predictive tool in managing fire activities.

Increased use of Datapoint computers throughout the Park Service has made the AFFIRMS program available to areas that have been reliant on manual computations or the Texas Instruments TI-59 hand-held calculator for non-archived index calculations. Some additional hardware may be required, depending on the user's present Datapoint equipment.

For example, Wind Cave has a DP 1800 Processor with a 2400 Baud modem (2400 baud is standard throughout the Rocky Mountain Region for administrative transmittals). However, AFFIRMS sends at either 300 or 1200 baud. Therefore, a combination of hard-and-software was acquired to "translate" between the different rates and allow the park to use AFFIRMS locally.

The interface procedures involved were developed by the Pacific Northwest Region and provided to the Branch of Fire Management, BIFC, in July, 1983. Once AFFIRMS is telephonically accessed the user must then follow the normal AFFIRMS operations.

Paul Broyles
Wind Caves NP
Hot Springs, SD 57747

From Yellowstone NP

The file handling capabilities of the Datapoint system used in Yellowstone are useful for inputting data to the system. I have used it extensively to input data from field forms and to manipulate the files created for analysis and printed output. These programs are written in the Databus language and were done before Multiplan was available. Some of the work may be easier to enter under Multiplan, depending on the size requirements of the data base. Once the data are in a file form from Multiplan, they could be manipulated with Databus programs or RMS or DOS commands. I have also found the chain file capability of the Datapoint system quite useful. Two or more programs can be called into service automatically after data are input to the terminal.

I have written seven programs, which so far are poorly documented but if anyone wanted a copy of the documentation it could be produced quickly. An example is RDNFPLT/Text:W, a program to build a file of vegetation plot data from field forms. The text file produced consists of a long list of records. The first record is a plot header that gives the plot number, location, and physical parameters of the site. Following that, each species is listed with its cover value. In application programs, the plot header is used to distinguish between plots.

One of the next programs I plan to write will look through the file and find the locations of a particular species. I would be glad to correspond with anyone interested in such programs or other applications of the Datapoint systems.

Don G. Despain

The Greater Yellowstone Area, which includes Yellowstone NP, is using an animal tracking program for the grizzly and black bear monitoring system. The majority of the 1983 information has been put into the system and we are planning to use this system, without backup from the previous system, in 1984. To date, the input program is workng well, and the search/selection program has provided us with a useful managment tool.

We are using a set of programs for the input and analysis of the research/resources management data.

I. Data Input Program (Datapoint – "Databus" language). Data can be a mixture of literal, numeric, or coded types.

II. Data Search/Selection Program (Datapoint – "Basic" language).
    A. Through Interaction Program
        1. User designs search for any combination of data values.
        2. User designs tabular output of any data fields in any order
        3. Sorting of records can be requested.
    B. Modules can be added to increase capabilities for special reports, calculations, etc.

Sandi Fowler
Yellowstone NP, WY 82190

DING DONG DINER

Dr. Jack Engle, on board the NPS vessel Pacific Ranger, *uses an Apple computer to determine adequacy of samples taken for monitoring population dynamics of kelp forest organisms in Channel Islands NP.* (Photo by D. Gotshall, California Dept. of Fish and Game)

Channel Islands NP Develops Microcomputer Based Info System

By Gary E. Davis

Channel Islands NP began an ambitious natural resources monitoring program in 1980. The basis of the program is a series of 16 research projects. Each project designed a population dynamics monitoring system for a major taxonomic group such as sea birds, island plants, or marine invertebrates. In addition to providing managers with information they need to protect and manage park resources, the monitoring program will satisfy Section 203 (a) of Public Law 96-199, which requires that the status and probable future condition of plant and animal populations in the park be determined and reported to Congress biennially.

At the outset, with normal constraints on manpower and funds, it was apparent that an automated system was needed for managing and analyzing population dynamics data and for preparing species lists and reports. The design of this Resource Information Management System was the No. 2 priority research project for the monitoring program and its design process followed four steps:

1) definition of the task, 2) selection of available application software (programs) to do the job, 3) selection of hardware available to support the software, and 4) implementation and modification of the selected hardware and software for the specific tasks of the resource monitoring program.

The first three steps have been completed. The fourth step is an ongoing process that integrates the results of the research design studies as they are completed into a unified monitoring program. Minor modifications probably will continue at a low level as long as the system is in use.

Task Definition

Natural resource monitoring at Channel Islands NP requires management of population dynamics data, bibliographic information, and textual material. Data on the abundance, distribution, reproductive efforts, recruitment, phenology, population age and sex compositions, growth rates, and mortality rates of a diverse assemblage of plants and animals must be stored, manipulated, and retrieved. Taxonomic data for the nearly 2,000 species that occur in the park must be maintained to provide ready reference for scientists and managers, and to produce specialized species lists for individual islands, biogeographic zones, or interpretive programs.

The scientific literature on the park's natural resources is extensive (over 4,000 citations) and is growing steadily. A system for managing this bibliographic information is needed to provide managers with the best available information for timely decisions, and to allow scientists and resource managers to efficiently review previous work on particular resources in the park. Preparation and presentation of professional reports on the status of park resources

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requires sophisticated word processing and high quality printing capabilities. In summary, this system must be able to store, manipulate, retrieve, and provide hard copy of digital, graphic, and textual material.

The work environment also is an important aspect of defining the task. Channel Islands NP consists of five islands, isolated from the mainland by 11 to 36 miles of ocean: fully one half of the park consists of submerged lands and waters surrounding the islands. Much of the resource monitoring activity, even of island-based resources, utilizes relatively large NPS vessels, which can provide quasi-reliable electricity and shelter from the weather for extended periods of field work. Under these circumstances, it is desirable and possible to take some aspects of the information management system into the field to evaluate the adequacy of samples or confirm unusual observations without incurring the extraordinary expense of additional field trips. The major data management functions of the system must be self-contained and at least partially portable to provide this capability.

Another factor important to defining the requirements of the system was that little, if any, information would be exchanged with other automated data bases. This system should be able to function as an independent tool as well as being linked with other systems to exchange information.

Selected Software

The nature of these tasks and the anticipated low volume of information indicated that a microcomputer system would be adequate. Hewing to the axiom that simple is best, we set out to select the best available microcomputer software for data management and word processing. Two things overwhelmed us at once: the vast array of inexpensive applications software on the market and the extremely high rate at which it was growing. After struggling for years with massive programs costing hundreds of thousands of dollars, it was astonishing to find similar data management capabilities in programs costing $90 to $500!

At this time our system utilizes 10 software packages for data management, modeling, statistical analysis, graphic presentation, and word processing. Three programs were selected initially for data management, and a fourth was added when it became available two years later. The Channel Islands system currently manages data bases with The Data Factory, DB Master, and MDBS. Data bases using dBase II are being developed. These generalized programs range in complexity and capability from extremely simple to sophisticated. They permit resource managers and scientists with little or no computer programming ability to create and use customized data files and reports for their individual needs.

An electronic spreadsheet program, VisiCalc, is used to model boat and visitor use in the park for the monitoring program and has a number of administrative uses as well. Statistical analyses of resource monitoring data are conducted with Microstat, which provides a wide array of descriptive statistics, analysis of variance, correlation and regression, time series, and nonparametric tests. DB Master's Stat Pak has a more limited menu of analyses, but is very convenient for use with data stored in DB Master files and provides most of the standard analyses. The Apple Stepwise Multiple Regression program provides the capability of sophisticated analyses of environmental factors and population dynamics.

In addition to the graphical displays available in these statistical programs, a program called Apple Plot provides the system with the ability to present data in a variety of graphical formats. Wordstar, with its auxiliary programs, Mailmerge and Spellstar, provide professional word processing capability.

Selected Hardware

In 1980, when the Channel Islands NP Resource Information Management System was being designed, the selection of microcomputer hardware was more limited than it is today. Among the companies that had established reliable reputations and would probably survive long enough to support the resources monitoring program, Apple computers had a clear advantage in the array of available software that would provide future flexibility for the system. Nevertheless, there were several important programs needed for the information system that required a different operating system than that offered by Apple. This problem was solved by placing a Z-80 microprocessor in an Apple II Plus computer to provide both Apple and CP/M operating systems in one machine. Wordstar, Microstat, and dBase II run under CP/M, and the rest of the programs in the information system run under the Apple operating system. Both letter quality and graphics printing were required, and a printer that could withstand the rigors of shipboard operations was needed. These diverse requirements were best met with two printers: one an expensive, complex impact type, a Qume Sprint 5, for office letter quality products, and the other an inexpensive dot matrix type, an Epson MX-80, for shipboard operations and graphic displays. This configuration of hardware: an Apple II computer with a Z-80 microprocessor, four 5¼" floppy-disk drives, a high resolution viewing screen, and two printers, supports the application software needed for the Channel Islands NP Resource Information Management System.

System Implementation

Implementation of the information system is progressing slowly as data are acquired and analytical and reporting requirements are defined by the research design studies. Population dynamics data on sea birds, pinnipeds (seals and sea lions), marine invertebrates, marine plants, and fishes presently are managed with DB Master and Data Factory files. These data are analyzed with Microstat and DB Master Stat Pak programs. Parkwide species lists are maintained on DB Master files. A 4,000-entry bibliography on park resources is maintained on an MDBS file. A model for monitoring boating activity in the park runs on VisiCalc. Weather data files are being developed with The Data Factory and DB Master, and dBase II files are being studied for management of vegetation records. The first biennial report to Congress required by PL 96-199 was prepared using Wordstar, and the preparation of a large number of other reports, manuscripts, and correspondence has been facilitated by the system's word processing capabilities.

Park operations beyond research and resource management have benefitted from the establishment of the Resource Information Management System. Property inventories, SCUBA dive logs, and case incident records are managed with The Data Factory and DB Master. Routine status of funds reports are prepared using DB Master, and monthly public use report data are developed and maintained on VisiCalc files. Preparation and revision of lengthy reports and plans have been facilitated by the word processing capabilities of the system. Significant cultural data bases on the park's archeological and historical resources are being prepared for inclusion in the information system. Bibliographic information on cultural resources already has been incorporated.

As the process of translating research results into

information crossfile

Daniel S. Greenberg, editor and publisher of *Science & Government Report*, an independent newsletter based in Washington, D.C., wound up a recent column with "two other elements" he said he had recognized as "fairly standard in the computer trade:"

"The first is that all machines are advertised as simple and self-explanatory — to the effect of just turn it on and you are ready to go, which is akin to telling career pedestrians that they can drive on the interstate highway first time out. The second is that it is a rare salesman who knows how to operate these purported embodiments of simplicity."

* *

Joseph Weizenbaum, a professor of computer science at Massachusetts Institute of Technology and a pioneer in the development of the computer, was interviewed for the March 1984 issue of *Harper's*, and offered a dissenting view on what he calls "the computer fad."

"The temptation," he said "to send computers wherever there is a problem is great . . . The introduction of the computer into any problem area, be it medicine, education, or whatever, usually creates the impression that grievous deficiencies are being corrected, that something is being done. But often its principal effect is to push problems even further into obscurity — to avoid confrontation with the need for fundamentally critical thinking."

And then there was *Shoe* . . . the disheveled editorial owl, by Jeff MacNelly. In a recent strip, Irving informs Shoe that he has built a new word-processing system "with all the glitches removed. No more worrying about losing your stuff someplace in the memory bank — or having your screen jus' go blank — or waiting for the printout!! No sir! This little beauty bypasses all that complex microcircuitry, the floppy discs, the bulky printers, and other this and thats!! This is the 21st century answer to today's awkward, cumbersome word processors. With my new system you can actually compose right at the keyboard and get instantaneous printout — with a foolproof memory and retrieval capability AND — the greatest technological breakthough of all — it sells for only $119.50. Gentlemen, I give you . . . the UNDERWOOD!!"

management action continues at Channel Islands, the Resource Information Management System will become the focal point of critical decisions involving the future of park resources. While it will be crucial that the system be able to manage the *information*, it will be even more important that park managers and scientists be able to effectively manage the *system*.

The kind of information developed here at Channel Islands NP has the potential of solving one of the National Park's most pressing challenges: how to do more high quality work with fewer people in less time. Today's managers and scientists need to become "hands-on" users of these information systems if we are to keep pace with developments outside of the parks and continue to protect the integrity of park resources.

Davis is Research Scientist at Channel Islands NP

Microcomputer — New Tool of Communication

By John Hoke

In the Spring of 1980, this writer acquired a small microcomputer system — primitive, by today's standards, and lacking many of the "bells and whistles" current machines exhibit. But this modest system enabled the user to vastly improve the efficiency and effectiveness of a host of many workaday tasks.

A 'Field'-Supporting Tool

While a microcomputer is usually associated with 'numbers-crunching' its capabilities go further. I have used it frequently to help communicate information about such chores as the testing of new tools and technology. An example includes an effort to make the management of the water bodies on the National Mall less costly. 'Swimming-pool' treatment techniques used earlier involved frequent, messy, and costly purges and cleaning of the pools. These systems now are kept healthy by managing them as self-sustaining, self-cleaning living aquatic ecosystems. But this involved making many changes in our maintenance techniques and the use of new tools.

Complete with Pictures

Each change in technique had to be tested first. The writer would photograph the trial operation with polaroid shots — and then quickly dash off the whole thing on the microcomputer, while the memory of it was still fresh. Using a word-processser program, the story-telling sequential aspects of the effort could be set down, with gaps left in the evolving text to accommodate those pictures that best illustrated the test effort. The final result was usually a one or two-page treatment then run through a copier for distribution to staff and maintenance forces who would have to make the system in the future. Being a 'one-man' operation and used to being strapped with the multiple-drafts process that so often attends going from idea to final copy, I found the microcomputer process was fast and got the results quickly into the hands of those who needed it.

To Make 'Spreading the Word' Easier and Faster

These mini-reports were not works of art (although polaroid pictures reproduce well on a photo-copier in good condition), but they guaranteed that everyone involved had a clear understanding of whatever new process was being explained. On occasion, from start to finish the time lapse was one of overnight delivery. Subsequent refinement made these papers publishable in journals with wider distribution.

Simple Chores Made Easier

While also respected for its ability to handle vast amounts of data, equally appreciated is the easy way the microcomputer handles such mundane chores as writing up flawlessly-executed requisitions and other administrative 'formulary.' For example: you can "blank out" a basic DI-1 form as a small mini-program you can store on a disk. It then becomes a snap to call it up when needed and just "fill in the holes" with specific ordering information. When you print it out on the DI-1 form itself, everything falls in the right blocks and lines of the form. Should it be a frequently requisitioned item, this, too, can be stored for future call up, revision, and re-ordering.

Their Use as 'Word Processors' Will Always be Important

While microcomputers are noted for handling numbers and data manipulation chores, their potential really is much broader. The typical resource management project consists of two major tasks: Collection and analysis of data and conversion of this summary data into graphic and, ultimately, written format. Somewhere along the line it is equally important to write up whatever you are doing in clear, concise English.

New Programs Combine These Abilities

The resource manager will find that new microcomputer technology includes combined data-managing and "writing" software that can help provide the kind of bottom-line results in the format best understood by management staff. These new "integrated" programs make it easier both to gather and analyze data — and then to render it in a form easily understood by people of many differing disciplines.

A Microcomputer is Simply a New Communications Tool

Resource management specialists and related professionals will find the microcomputer an effective communications tool. Aside from its ability to produce results in a hurry it is uniquely able to render results with greater clarity. With a microcomputer one person — one mind — can stay on top of the process, from beginning to end. Often, the vital element of clarity becomes lost when too many people, lapses of time, and sometimes even lapses of memory occur during the execution of work.

Their Programs Make Them Flexible Tools — For Everybody

With the ever-growing kinds of programs the microcomputers can use — available at a nominal cost compared with almost any form of fixed-station computer or word-processing systems — a microcomputer system can be as varied as the tasks that face NPS resource management. To make sure that what comes out at the end of the process will be readable, it is suggested that the data-related programs you select also include a good word-processing program. (And this includes hardware capable of producing letter-quality copy: Unless it is of superb, almost deceptive quality, dot-matrix printing of textual material gives many readers — particularly editors — a headache.)

You Don't Have to Know Something Special to Use Them

You do not have to know touch typing to utilize word processing programs with these systems. With a word processor program any kind of typing is made worlds easier; correcting mistakes is a snap on a microcomputer — regardless of how well you can type.

There Is No Microcomputer for All Seasons

Our diverse professional roles rule out finding any basic, or standard microcomputer system — something everyone will use. Trying to find a single system that can network the whole National Park Service, and thus be cheaper-by-the-dozen, can be hazardous. Their basic virtue — flexibility — may well be sacrificed in the process. Developing a single vehicle that will fly, land on the water, sail on it, travel submerged, crawl out on dry land and then traverse it — and do all these things fast — sounds like a great idea. It may even be possible to make a vehicle that *does* all these things but there is doubt that it could do any one of them *well*. No such vehicle exists — and this goes for microcomputers, too.

The key to any search for uniformity lies in selecting software programs that are widely used by the many microcomputer systems now available — programs that can "talk" to almost any system. If you select compatible software program packages, equipment choice can then be confined to hardware that handles graphics requirements best, is easily portable (for use in the field) or otherwise best meets some individual or special requirement.

They Can Really Reduce Costs

The Darnell Institute of Business indicates that the cost of doing a standard letter — from idea to mailed envelope — has risen to $7.60. Herein lies another mundane, but fruitful, use of the microcomputer. Many communications can be moved via a short note attached — one that you quickly compose and type yourself. The use of formal letters and memoranda thus can be reduced.

Using a microcomputer vastly simplifies filing needs: Reams of copy can be stored on small floppy disks. Whole filing cabinets full of stuff will fit on maybe a dozen of them — in a small box on the corner of your desk. Professionals who are bereft of (or must share) secretarial support will find this feature of particular benefit. And with the 'search-and-find' capabilities of the microcomputer, records on disks are worlds easier to find.

They Can Vastly Expand the Scope of Your Work

Microcomputer capabilities are mind-boggling and often frighten the timid. But the instrument remains no more than a fine new tool. The use of only a fraction of its potential can result in savings that more than return the investment, compared to doing business "the old way." And those who have reason and ability to exploit the technology's full potential will find they have increased incredibly their professional scope and productivity.

Hoke is with the NCR Division of Resource Management and Visitor Protection.

Everglades System Facilitates Data Transfer

By Rick Dawson

In the process of managing the natural resources of Everglades NP and Ft. Jefferson National Monument, many types of information are generated. This information may have its genesis in formal research studies or in natural resources monitoring programs. However, all of these data can be used to assess the condition of the resource and evaluate corrective or mitigative measures. The massive loads of data generated in the programs involved are currently being put on two data management systems.

One system (512K CPU, 8 interactive terminals, 80MB hard disk drive, .75MB triple floppy disk drive, 9-track tape drive, drum plotter, card reader, and high speed matrix printer) is housed at the South Florida Research Center and primarily handles data concerned with research studies. The other system (256K CPU, 8 interactive terminals, 80MB hard disk

drive, .50MB dual floppy disk drive, daisy wheel printer-plotter, and high speed matrix printer) is housed in the Resource Management section and primarily processes data accumulated from monitoring and resource manipulative studies and programs. Both systems are Wang Model 2200 MVP 16 bit processors and are equipped with AIMS PLUS software packages. Since the systems are essentially identical, data between the two are transferred easily for integration and analysis.

The major resources problems affecting the park currently are centered around water management, fisheries management, endangered species monitoring, management of exotic vegetation, fire management, and backcountry campsite utilization. Additionally, programs are being developed to handle budgeting and personnel, training, case-incident reporting, special use permits, and collecting permits. Both systems are capable of supporting word processing; the resource management system is equipped with the Wang word processing software.

Utility of the current hardware is twofold: data entry, editing, and analysis; and, data management for use on mainframe systems. These two uses are critical since many of the studies that contribute data to their respective databases require preliminary statistical analysis in order to test for significance and generate resource fitness reports.

However, many of the problems being studied, along with the resource use and abuse being monitored, may be influenced by water management strategies. Therefore, to gain a clear understanding of various ecosystem forcing functions it will be necessary to integrate many varied databases with those collected and assembled by the hydrology research group. This integration may require pre-treatment prior to analysis on a time shared mainframe.

The databases on-line on the research center system are: hydrology, wildlife, marine resources, and vegetation. Of these, hydrology is the largest and most complex. It is subdivided into into files dealing with water depth at monitoring stations, discharge, estuarine tidal data, temperature, and precipitation. The analyses to which these data are subjected are mostly standard statistics but include reports and predictions of flow/discharge.

The system provides data for a monthly synopsis of hydrological conditions which is distributed to all park divisions. The water resources database occupies about 17MB of storage.

The wildlife database handles collected information on ospreys, bald eagles, alligators, and freshwater fishes. In the case of ospreys and eagles, nest activity is recorded with subsequent analyses for population size, nesting success, and environmental parameters that may affect their productivity. Data collected on alligators records such parameters as nesting success, food habits, and age-growth. Freshwater fish data are concerned primarily with food habit studies. The majority of the analyses performed on the data are to determine the major prey items for each species along with the frequency of occurrence and percent volume of the prey items.

The research marine resources database contains information from on-going studies on shrimp abundance and seasonal distribution; coral reef water quality; and, sportfish age-growth. All these studies require standard statistical analyses to be performed on their data sets. The application of these products will be to determine habitat preference (shrimp), impact of onshore development and human impact on coral reefs; and, length-age relationships/mortality of selected sportfish populations. This database oc-

cupies about 5MB of storage.

The research vegetation database concerns itself with data generated from evap-transpiration studies. these data will be used to determine the amount of water loss through evapo-transpiration for the eventual development of a park water management model. This database requires 2MB of storage. Much of the software used for the analysis of research databases is custom designed for a specific database and a desired product; however, there is an increasing level of use of the AIMS PLUS applications generator for routine data management functions.

The resource management databases are marine resources, fire, vegetation, and backcountry campsites. The marine resources database consist of data collected by recreational fishermen creel census, mandatory catch log reporting by commercial and professional guide fishermen, fish length measurements, boat trailer ramp counts, actual boat counts (aerial census), and commercial/guide fishing permittee information. These data are managed to be reported on a variable time increment basis with standard statistical treatment of the database selected. This database contains 40MB of data collected from 1958 to the present. Uses for these data are to monitor harvest and effort on the park fishery. Also, they can be conveniently integrated with the research age-growth database for a more detailed analysis of finfish populations and their response to environmental and human impacts. The database has the ability to generate the 270 commercial and professional guide fishing permits issued per year.

The fire database is concerned with management of the extensive library of fire data collected by the park since 1952. This database occupies about 5MB. The vegetation database stores data collected on park exotic vegetation and farmland reclamation projects. These data are analyzed to determine the extent and effects of exotic vegetation control work and to document successional vegetation changes on abandoned farmlands within the park. They occupy about 7MB of storage.

The backcountry campsite database utilizes information collected from the backcountry permit program and provides data on site use at backcountry facilities. It requires about 4MB for storage. Most of the fisheries and backcountry use databases are analyzed with custom designed software, whereas, all of the fire, vegetation, and budgeting software has been generated using AIMS PLUS.

Coincident to the maintenance and use of these databases, we are currently developing programs for the entry and analysis of Case Incident Reports and fish kill investigations. On both systems resides software for the tracking of funds, budget projections, and FTE's.

Besides providing the capabilities for more efficient management and storage of data collected by monitoring and research programs, the real benefit of these two identical systems lies in the relative ease of transfer of data between researchers and resource managers. This integration of data will deliver the ultimate goal of both programs, which is an increased understanding and more competent management of an extremely complex ecosystem. The tool to accomplish this goal will probably be a fully integrated model of the Everglades ecosystem. The development of such a model would be impossible without versatile and adequate automatic data processing equipment.

Dawson is a Resource Management Specialist in Marine Resources at Everglades NP and Fort Jeffersen, NM.

IBM Personal Computer Lab Showcased

By Dominic Dottavio

For the past two years the NPS Southeast Region has been developing microcomputer capabilities throughout the parks of the region. These efforts have resulted in a network of over 50 IBM Personal Computers (PC). Concurrent with this effort, the College of Forest and Recreation Resources at Clemson University has been engaged in a program to upgrade the management of natural areas through a regional information/communication network. The University's program received major impetus through the location of an NPS Cooperative Park Studies Unit (CPSU) in the College. One of its missions is to assist in developing the regional NPS computer system. The College viewed the National Park Service's developing network as a model that should be emulated by other federal and state land management agencies.

As both programs developed, it became clear that the capabilities of the technologies were outstripping the capabilities of the users to make full and creative use of the systems. Both organizations were concerned that the personal computer network would fall short of its promise due to human constraints.

To address this problem, the College of Forest and Recreation Resources and the Clemson CPSU approached International Business Machines, Inc. (IBM) seeking the company's cooperation and partnership in developing a training laboratory featuring the IBM Personal Computer. In September, 1983, IBM responded favorably to the request.

The proposed laboratory will be located on the Clemson University campus adjacent to the CPSU and will provide network links to the NPS system. The laboratory will be wired to accommodate PC to PC communication, PC to main frame (the Clemson IBM 3081) communication, and stand-alone PC capabilities.

IBM is viewing the lab as a showpiece on networking possibilities and is therefore considering installation of the most advanced communication systems available for the Personal Computer.

Equipment for the laboratory will include 19 IBM Personal Computers, with a least one of each model type being represented; printers, instructional projection monitors, modems, and a variety of application software. In total, the grant from IBM is expected to approach one-quarter million dollars.

This facility is being viewed not only as a showpiece for displaying sophisticated equipment, but also as a model of federal, state, and private sector cooperation and partnership. The combination of the resources and talents of the three organizations has resulted in a mutually beneficial, cost-effective means of meeting the needs of each organization.

Dottavio is Research Coordinator at the NPS/ CPSU, Clemson University.

regional highlights

North Atlantic

The North Atlantic Region's Division of Planning and Resource Preservation has purchased a small computer system, based on a Hewlett-Packard 9845C microprocessor with a color CRT, a 9874A digitizer, a 9872A 8 pen plotter, a 9895A flexible disc drive, a 2631G impact printer, and a 9871A daisywheel printer. The Division of Management and Operations, (encompassing Natural Resource Management and Visitor Protection) has acquired a Datapoint system, which includes an 1800 microcomputer with two diskette drives and a dot matrix printer. Since the installation of these two systems several program operations have been automated with new computer applications being developed to assist research, planning and resource management efforts.

For example, in the Office of Scientific Studies, monitored air and water quality data bases have been computerized and vegetation, soils and shoreline maps have been digitized from recent aerial photographs and historical maps. These computerized and digitized data are easily displayed in graphic form on the 9872A for interpretation by staff scientists and resource managers. Vegetation maps such as the Fire Island National Seashore Vegetation map shown in Figure 1 have been used extensively in field research projects. The Fire Island maps have been used in a fire ecology research project as well as to identify air quality sensitive vegetation.

The quantitative nature of the digitized maps permits numerical analysis of vegetation change or, as in the case of shoreline maps, the rate of shoreline change can be determined. Temporal variability in shoreline mobility trends range from the long-term (150-year coverage afforded by NOS "T" sheets) to the short-term intervals of recent aerial photography. The area changes also are combined with selected, digitized beach profiles to yield the volumes for sediment budget analysis. The monitored data and digitized maps are updated periodically to show resource changes in response to natural and anthropogenic source disturbances.

Resource managers in several park units in the Region (three to date) have easy access to this system using HP 85 remote terminals. These areas have begun to telecommunicate resource information for analysis and storage. The terminals also are used to retrieve meteorological data from remote automated weather stations (RAWS). RAWS transmit meteorological data through the GOES satellite to several surface locations, allowing the measurement of weather conditions at remote park areas. These data are accessible through the AFFIRMS system for use in calculating fire weather.

New applications planned include cataloguing all natural resource reference material, which is located in the regional office and available for use by regional and field scientists, resource managers and planners.

The Office of Planning and Design will use the HP 9845C as an environmental simulator for the Battle Road Development Concept Plan being prepared for Minute Man National Historical Park. The impact of proposed scenarios for Route 2A (running through much of the Park) on cultural resources and visitors will be assessed by means of three dimensional computer graphic simulations of the Battle Road Corridor. This process also will be used to help guide the final siting of a through-park bikeway. Most importantly, the simulation capability will help park management to prepare well documented responses to State and Regional transportation proposals and to better plans for preserving the integrity of the historic Battle Road.

The Datapoint 1800 system in the Division of Management and Operations includes a Universal Data System (UDS) 212A modem (300 or 1200 Baud) which connects the Datapoint microcomputer, using telecommunications, to other computer systems in the NPS as well as to other agencies (such as BLS Inquire Data Bases and AFFIRMS). A Co-axial cable connects the Datapoint 1800 to the ARCNET system which uses the Datapoint 6600 as a file processor. With access to the 6600 system (located in the NAR Information Management Division within the Directorate of Administration), the storage capability of the 1800 microcomputer is greatly increased. Several NAR parks also have Datapoint systems so, with use of modems, natural resource information can be transferred electronically.

Management and Operations obtained the Datapoint 1800 last year and the development of computer applications for management of Natural Resource data has begun. For example, wildfire reports (Form DI-1201) are now entered on the com-
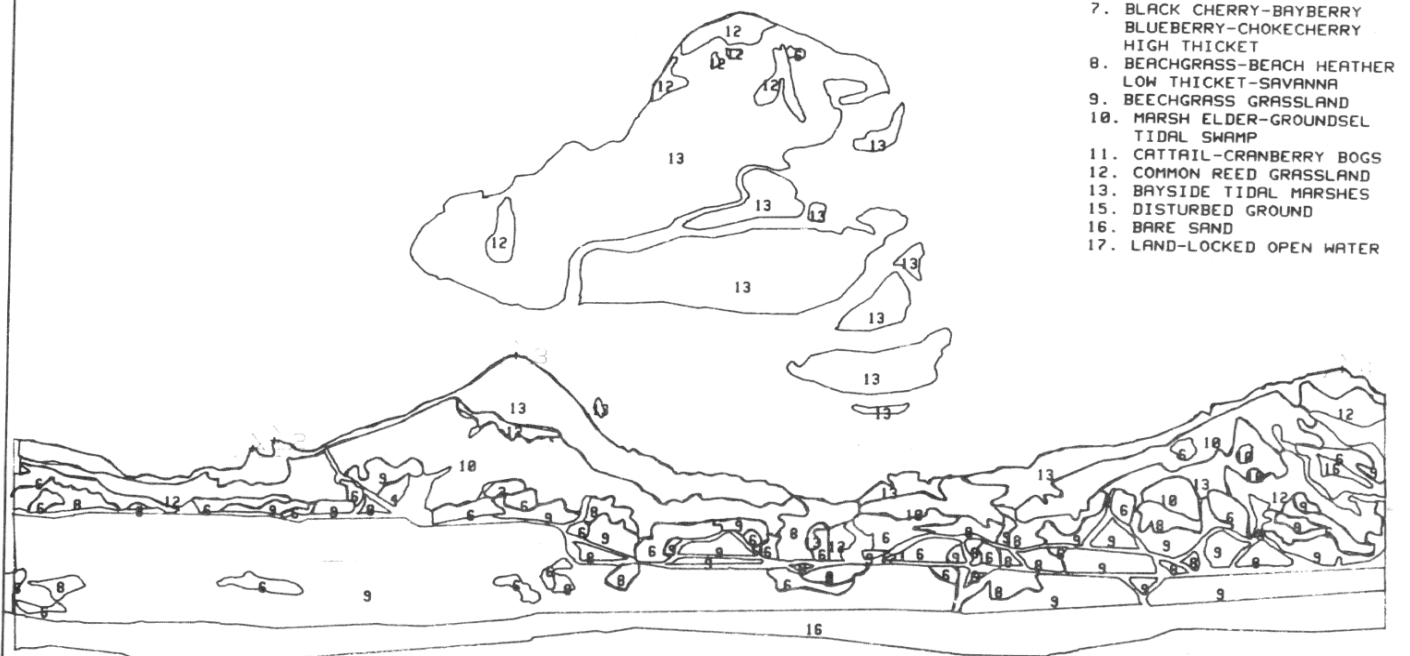

FIRE IS VEG(NF-4A)   D1009:H7,7,1

1. HOLLY-SASSAFRAS-SHADBUSH
   BROADLEAF FOREST
2. PITCH PINE WOODLAND
4. BEACH HEATHER DWARF SCRUB
5. BEARBERRY DWARF SCRUB
6. BEACH PLUM-POISON IVY
   BAYBERRY-BLACK CHERRY
   LOW THICKET
7. BLACK CHERRY-BAYBERRY
   BLUEBERRY-CHOKECHERRY
   HIGH THICKET
8. BEACHGRASS-BEACH HEATHER
   LOW THICKET-SAVANNA
9. BEECHGRASS GRASSLAND
10. MARSH ELDER-GROUNDSEL
    TIDAL SWAMP
11. CATTAIL-CRANBERRY BOGS
12. COMMON REED GRASSLAND
13. BAYSIDE TIDAL MARSHES
15. DISTURBED GROUND
16. BARE SAND
17. LAND-LOCKED OPEN WATER

Figure 1

puter as they are received from the parks. The Multi-plan software allows easy access to fire records and quickly tabulates regionwide totals of variables such as acreage burned and expenditures related to the fires. The AFFIRMS system has been used to access and retrieve weather data to use in fire weather calculations. Special Use Permits also are on the Datapoint system using Multiplan.

This year the 1984 Pest Management Program submissions (FORM 10-21A and pesticide use logs) will be entered on the microcomputer. This will facilitate regional and WASO review and allow rapid searches for control measures currently in use at NAR park areas. Access to WASO computer systems may eventually allow submission of pest management reports using the computer.

The North Atlantic article was prepared by Mary K. Foley, Rolf Diamant, James R. Allen, and Nora J. Mitchell.

Southeast Region

For several years Clemson University has conducted a resource management training institute for NPS. In Spring 1983, a minicourse in microcomputer applications was offered for the first time, covering 1) an introduction to basic microcomputer concepts, 2) hands on application of a resource management computer program, and 3) introduction to database management.

The hands on resource management computer program (called RESDEMO) was developed by the Clemson CPSU in consultation with the Ranger activities division of SER to provide resource managers with examples of how microcomputers could help them do their jobs more effectively.

The RESDEMO software package is a self explanatory, online query system that allows easy access to the following kinds of information: services and facilities in specific parks, emergency procedure information, resource management project statement information, and a listing of resource management experts around the country.

If, for example, you wanted general information about the Great Smoky Mountains NP, RESDEMO would provide you with the park's address, phone number, a brief description of the park, and a list of the facilities and services available. You could also access all the parks in a specific state or region; you could specify the order of the listing; you could list the parks alphabetically, by date of establishment, or by size (acreage).

With respect to emergency procedure information, RESDEMO provides information on how to deal with emergency situations. You could list fire emergency procedures for either structural or wildlife fires, search and rescue procedures, natural disaster procedures, law enforcement emergency procedures, and oil spill or abandoned chemical container handling procedures.

One of the most useful aspects of RESDEMO is the ability to obtain resource management project statement information by park or entire region. RESDEMO will identify cost, person year, priority, fiscal year, and project description information. Totals, costs, and person years for selected projects are automatically provided. For example, you can ask for a statement of the natural (versus cultural) projects having a priority of one to six for Biscayne and Great Smoky Mountains NPs, including a list of projected costs for 1-5 fiscal years. This request would result in a list of all the natural resource management projects for Biscayne and the Great Smoky Mountains that

have a priority from one to six, as well as the estimated cost and person years for the fiscal years 1-5 for each project. You would also receive the totals for each park along with the grand totals for both parks.

Finally, with RESDEMO a resource management specialist could access a listing of resource management experts on a park, state, or expert area basis. Phone numbers, addresses, and parks in which the experts have had experience are provided.

RESDEMO was written using dBASE II and runs on an IBM Personal Computer with 128K of memory.

CONTACT: Dominic Dottavio, NPS/CPSU, Clemson University, Clemson, SC 29631.

Pacific Northwest

During the past year, the College of Forestry, Oregon State University, has offered three introductory microcomputer workshops for resource managers. Ed Starkey of the NPS/CPSU has served as a co-director. An additional workshop is planned for June 19-20, 1984.

Objective of these workshops is to familiarize resource managers with the general operation of microcomputers. No previous experience with computers is required. Instructional format combines lectures and discussions with ample opportunity for "hands-on" experience. Participants are introduced to a variety of commercially available programs, with examples and exercises emphasizing managerial applications. Individuals contemplating the selection of microcomputer hardware and/or software find the workshops especially useful.

CONTACT: Ed Starkey at 503/754-2056 or the Conference Assistant at 503/754-2004.

National Capital Region

The 14 parks of the NCR are in an area marked by rapid environmental change. A systems approach — with the aid of computers — is needed for creating, storing, updating, and accessing natural and cultural resources data to assist park managers and their staffs in making appropriate decisions. With the guidance of the Science and Remote Sensing Sections of the Denver Service Center, the NCR is developing a computerized system for use in the parks and in the Regional office. Currently all data are being entered into computers in DSC for later use by the Region and parks as hardware becomes available. During FY 1984 various types of hardware including software packages with graphic and digital plotting capabilities will be examined toward developing inhouse capability by FY 1985.

As part of this program the entire Region was flown during FY 1983 to obtain color infrared photography and aircraft multispectral scanner data for all park units. Photointerpretation followed by ground truthing is being completed on a systematic basis, one park at a time, while at the same time several plots or themes involving soil groups, hydrogeology, boundaries, roads, trails, utilities and other land use patterns are being prepared in digital form.

Once basic resources are mapped and the computerized data base is created for each park, a multitude of analyses can be accomplished with a minimum of time and money. These analyses may involve integration of several themes that can be quickly viewed via computer capabilities, enhancing the decision process. Examples include fire management planning, exotic species management, vegetation management, wildlife management, wetlands management, historic scene restoration, agricultural leas-

ing programs, and changes in adjacent land use practices. The computerized approach in managing and planning park resources will immeasurably improve the NCR capabilities to respond to environmental changes.

CONTACT: Stan Lock, NCR, 1100 Ohio Dr. S.W., Washington, D.C. 20242.

* * *

From Malcolm Wilbur, also at NCR, comes word of CPT Word Processing equipment installed in all parks and most offices in the Regional Directorate. Most of these CPT's have telecommunications capability, most commonly used to send messages between the parks and Regional offices.

In the evolution of NCR's telecommunications capability will be the implementation of a Regional Electronic Mail system, using the existing Servicewide Mailbox and Bulletin Board. The Mailbox is for more formal memos and may only be received by those specified by the sender. The Bulletin Board, less formal, is intended to function as a clearinghouse for questions, suggestions, and ideas on any topic the user cares to address.

* * *

A computer based inventory and information system has been initiated for the nearly 2,000 elms which comprise the major arboreal component of the Monumental Core of Washington, D.C. Development of this system by Ecological Services Laboratory staff was spurred by the need to prepare an annual report for the city-wide Save-the-Elms taskforce and in response to the expressed need for such a system in the NCR Central resource management plan.

The system takes advantage for an existing series of grid maps utilized by the electrical utility, PEPCO. Each map represents a 1000 sq. ft. area on a scale of 1 inch to 50 feet, which permits good visual spacing of the elm trees. The tree locations were plotted in the field by starting from known points and measuring distances using a measuring wheel. After being plotted on the map, elm locations were fixed by superimposing a gridded mylar. Each tree on a given map was provided a three digit X coordinate and a three digit Y coordinate, corresponding to the map location. Data were collected on each tree including species, size, condition, location features, etc. These data, a backlog of historic data and future data on these elms will be entered in a soon to be acquired computer system using a data based management package (DBMS). The intent is to compile data and develop them into a tracking system which will yield the information needed for a more effective elm management system. This system is designed so that it can be expanded to include other components of the landscape.

WASO

The NPS has its own electronic Bulletin Board System, available (free of charge) as a communications/message exchange system to anyone, Servicewide. To use the system, all that is required is a terminal, microcomputer, word processor, etc. with asynchronous telecommunications capability (i.e., a modem). The system runs on the Hewlett-Packard 3000 minicomputer in Washington.

Users may read, write, and exchange messages with other users throughout the Service. Messages are "posted" under various topics. Users can create

new topic areas as the need arises.

The WASO Natural Resources Office is interested in promoting the use of the Bulletin Board as a communications medium for park and Regional Office natural resources staff to share ideas and compare notes on various natural resource subject areas. Some initial natural resource topics now on the Bulletin Board include Pest Management, Natural Resources Training Opportunities, Exotic Plants, Fisheries and Aquatic Resources, Fire Ecology, Man and the Biosphere, and Energy, Mining and Minerals.

CONTACT: Anne Frondorf, Biological Resources Division, NPS, Washington, D.C. or Keith Carr, Data Systems Division, NPS, Washington, D.C.

Midwest Region

The St. Croix National Riverway is using a Datapoint 8600 primarily for word processing applications. Datascan and Multiplan software packages also are available. The park's Resources Management Plan is on the system, which allows for quick and easy updating. Floral and faunal lists, cooperative agreements, and the Fire Management and Land Protection Plans also are on the system. The park does not presently have the personnel expertise or the programs to do any resource management analysis or resource inventory applications.

CONTACT: William Sigafoos, St. Croix National Riverway.

Alaska Region

The Natural Resources and Science Division in the Alaska Regional Office has recently acquired a Hewlett-Packard 9716-S computer with printers, plotter, and communications capability. The system became operational in October 1983. It will be used to conduct statistical analyses of wildlife data, to generate fire histories based on tree ring data, and to develop and manage data bases on plant community data, fuel loading data, etc. Initial applications have used commercially available software. Future objectives include the development of a geographic information system.

CONTACT: Gary Ahlstrand, Alaska Regional Office.

Rocky Mountain Region

Dinosaur National Monument owns a Model 1800 Datapoint DOS processor with 120K. Two disk drives allows for 2,000K disk storage. A Universal Data Systems, Model 201C, modem enables data transmission between the park and the Regional office in Denver. Commercial software includes Datapoint's IEOS (word processing), Datascan (a database-manipulation program), and Datafast (a program to write programs). Multiplan also is used on the system.

Other parks in the Region have written programs to track the park's funding obligations, annual budget and programming requirements, PRIP account status, and law enforcement/case incident statistics. The Regional office has written programs allowing payroll information to be put directly at the park level, which is much more satisfying to park employees.

We are in the process of computerizing our rivers permit system. We have programs to compile commercial and non-commercial monthly boating statistics and applicant data screens. The data screen program has just been received and has not yet been tested. Use of the program materials in 1984 will depend on time available for data entry after other duties, and the fundamental capabilities of the system.

Our goal for 1985 season and beyond is to integrate use of the computer in processing boating applications and river use statistics. This may require modification of some present procedures. Ideally, the computer would be used to screen applicants, assign lottery numbers, assign launch dates and campgrounds, issue permits, sort passenger lists for repeaters, and compile monthly and annual boating statistics. We also use and intend to expend use of the computer in word processing of boating forms, correspondence, and other printed materials.

CONTACT: Gary DeBusk, Dinosaur NM, P.O. Box 210, Dinosaur, CO 81610.

Mid-Atlantic Region

Shenandoah NP has only recently utilized its CPT word processor in the data processing mode for resource management activities. The only such current computer project is the recording of data from the nearly 8,000 backcountry permits issued in 1983. These are entered into the TIM data base management system. Several reports summarizing total nights, group size, location, day of week, issue point, etc., are available. Resource management activities we expect to computerize in 1984 include air quality, backcountry impact studies, creel census, stream analysis data, wildlife data, etc. We also hope to enter the resource management library into a library program soon.

In other fields, the computer is used for budgeting, law enforcement reporting, motor vehicle accident, manpower and equipment analysis for A76 review, etc. Several additional computers are to be added to the Park for administration, maintenance and management activities. Off-the-shelf programs used besides TIM, include Plan 80 (budget), FMS-80 (DBMS) and Compupak (CPM).

In the word processing mode, we have entered several resource management plans including Backcountry Management Plan, Resource Management Plan, and Vista Management Plan.

CONTACT: Larry Hakel, Shenandoah NP, Luray, VA 22835.

Southwest Region

The Southwest Region for more than six years has maintained a Data General Eclipse mini-computer, used almost entirely for archeological and cultural resource programs. In 1983, the Branch of Cultural Data Systems mounted the MOSS geo-based information processing system on the Eclipse. The software system, developed by USFWS and supported by the BLM and USGS is designed to permit the scientific study of biological and environmental data bases using high resolution graphics display. The software is currently under evaluation.

The Chaco Center continues to expand the capabilities of its Chaco PARKMAN data base program and is attempting to add predictive modeling routines to the extensive archeological and environmental graphics system.

A program to three dimensionally model the effects of solstice and other sun and moon declinations on La Fajada Butte petroglyphs has been awarded to IBAR Associates of California. This program will use its base Precision Visual's D13000 core graphics software. Delivery of this system, which will be mounted on the Region's new 32 bit CPU's, is expected in October 1984.

A fourth program, developed by Valeriana Enterprises and licensed to the Southwest Region, is the UCREATES Fortran Generator System. This system, written for Data General computers, allows inexperienced users to create Fortran source codes and complete working programs simply by answering sets of menu driven questions. New programs have been written using UCREATES for artifact curation, bibliography creation, inventory, stock room accounting, etc.

The San Juan Basin Archeological data base has grown to include data on over 30,000 archeological and cultural sites located in the Four Corners area of New Mexico, Colorado, Utah and Arizona.

In other fields, the Southwest Region expanded its computerization most recently into the realms of office automation and inter-computer networking. In 1983, the Southwest Regional Office procured two Data General MV4000 super mini-computers as the hub of a Regional computer network. The first was installed in February 1984. These are the same type of computers that the U.S. Forest Service is installing in all its installations, nationwide. The two computers will be used with a comprehensive office management software system called CEO. This system includes word and letter processing, document filing and transfer, personnel calendar and office scheduling. The combined Data General systems will be able to handle up to 128 terminals, peripherals and dial-up lines. The two CPU's will be linked using an X.25 packet switching software package called Zodiac. This will permit a user to access either CPU and also allow the addition of other CPU's should the need arise. An RJE80 interface to permit access to IBM Hosts has been included with the system.

Eight of the Southwest Region's parks have purchased comparable Data General Eclipse mini-computers in order to take advantage of mature scientific software developed at Region and elsewhere, and to participate in the planned network. Most of the Region's 36 parks are expected to follow suit, as funds become available.

CONTACT: Dr. Walter Wait, FTS 476-1775.

Niche Splitting

Nuthatch

Works

A tree

Trunk

Down

Creeper

Does

It

Up

Brown.

To a Lonely Hermaphrodite

Know

Thyself

Systems Application for Fire Management

By Scott Erickson

Information management and systems applications are no stranger to the interagency fire management community. By Park Service standards, astounding amounts of time and money have been invested to model and integrate information pertaining to wildland fire management. The NPS Branch of Fire Management, established in 1979 by the Director, has aggressively pursued moving the Service to the state-of-the-art level in systems applications.

The Administrative Forest Fire Information Retrieval Management System (AFFIRMS) with 55 users Servicewide, is the principal fire management application in use by parks. Several other systems applications, adapted or developed for use by the Service, include National Fire Weather Data Library (NFWDL), NPS Fire Occurrence Data Library, Yosemite NP Pilot Geographic Information System Data Base, FIREFAMILY, PRESCRIBE, and others.

Exhibits 1 and 2 shown here briefly portray major databases and interactive/batch packages. The FIREPRO effort provided the major impetus for Service-developed software and databases in order to integrate management information for decision purposes. Database work has scored major accomplishments in the last two years and further advances are in the offing.

It must be noted that all the applications (other than AFFIRMS) are resident on the USDA Fort Collins Computer Center Univac 1184. The Univac is a mainframe and currently utilized by Branch staff almost exclusively. This centralized access to applications has been a bottleneck to effective use by parks; so the Branch is obtaining Departmental approval to acquire a major minicomputer. All applications will be installed on the minicomputer, decentralizing access to fire management software applications. The current timetable calls for having the mini fully operational and available to park, regional, and national users by mid-1985. Several administrative and technical problems remain to be solved but the Branch of Fire Management is committed to providing state-of-the-art systems applications directly to end users.

Erickson is Fire Management Specialist at the Boise Interagency Fire Center, Boise, ID 83705.

EXHIBIT 1

DATA BASES	WHAT IS IT?	SOURCE OF DATA	WHAT IS IT FOR?	LOCATION
National Fire Weather Data Library (NFWDL)*	National multi-agency collection of computerized historical weather data.	1300 hrs ± 1 hr fire weather observations: WS form D-9b.	Planning for fire suppression and prescribed fire use.	USDA, Fort Collins Computer Center (FCCC).
FIREPRO Inventories**	109 parks Service-wide inventories, of weather stations, equipment, engines, aircraft, prescribed burn plots, agreements, real property value estimates.	FIREPRO input forms.	Budget evaluation for fire suppression.	FCCC

* USFS developed program
** NPS developed program

EXHIBIT 2

INTERACTIVE PROGRAMS	WHAT IT DOES	LOCATION
Administrative Forest Fire Information Retrieval Management System (AFFIRMS)*	AFFIRMS has several functions: 1. Fire reporting network. 2. Message posting to other users. 3. NOAA link to provide next-day weather forecasts and special spot forecasts. 4. Calculation and output reports on fire danger. 5. Archiving of fire weather observations.	Computer Sharing Service, Denver, Colorado. Time-sharing contract.
BEHAVE*	Interactive design of site-specific fuel models and state-of-the-art fire prediction methods utilizing NFFL stylized models or user-designed models.	FCCC

BATCH PROGRAM	WHAT IT DOES	INPUT DATA	LOCATION
FIREPRO**	Ten statistical analysis programs to profile park, regional and national fire occurrence Also a park budgeting application for fire suppression program requirements.	NPS Fire Occurrence Data Library FIREPRO Inventories	FCCC

Data Analysis Management In Remote Fields

By Robert Stottlemyer

Data management I define as a process for making data accessible and usable to others. If one accepts my definition, it logically follows that good data management should also lead to better data analysis by the researcher.

Four years ago I left the plush security of the bureaucracy and re-entered the research business in an academic community. The array of information I found routinely collected in field ecological study, which I had been familiar with years before was a startling change. But so too was the technology now available to handle such data. The question was, and is, how to match the two, for data generated in remote field locations.

Severe fiscal constraints, a long-term habit of composing on the typewriter, and faculty frustration with peripheral services on the university mainframe made the decision to buy my first microcomputer with word processing software easy. This was four years ago. Sure one can type faster on a wordprocessor, but it is the library buildup that really is the time saver. It is truly amazing how much of what we do on an annual basis is repetitive. That carefully prepared abstract for a national meeting can, with editing, serve as a progress report. Updating annual reports, vitas, follow suit. Fortunately, I purchased equipment from one of the three major manufacturers so a formidable array of software is available at modest cost. This also was a big help when I had to decide on an SPS package to handle the mounting data set being generated by a laboratory analyzing several thousand samples a year, each with over 20 variables. I could easily have gone with the university's mainframe. But faculty colleagues encouraged me to go "micro" all the way until file size dictated otherwise. Hardware advances have moved much faster than my file sizes and analytical demands.

Data organization and structure all too often do not get enough thought early in the game. I was fortunate in having to address this question at the beginning, when we developed a "universal" field data form. Two questions arose: "What are the types of entities about which we have data?", and "What data do we have about each type of entity?" Our spatial and temporal field data requirements were similar to those of a soils scientist, and a much modified computer-based soil science field form, which includes a "variable" for data documentation, has served us well.

The conduct of field research in especially remote sites has its own set of quality assurance problems. Data documentation serves to record those "field contingencies" which invariably occur with remotely-placed field recorders. But our work involves fairly sophisticated chemical analyses of field samples, and this must be done in a facility much removed from the sampling sites. While one can easily develop protocols for sample handling and data recording how can their effectiveness be checked?

The key is a vertically integrated quality assurance program which can respond in a timeframe sufficient to correct procedural errors before one or two additional sampling dates take place. For our work the need is to merge certain field data variables with laboratory analyses for "outlier" detection by regression.

Big Thicket Computer Capabilities Driven by Resource Management Needs

By Robert J. Krumenaker

Computers have been an integral part of daily life at Big Thicket National Preserve for almost two years. The driving force always has been resource management, but all of the Preserve divisions have integrated automated applications into their operations. If anything has been the hallmark of our success thus far, it has been the willingness of Preserve staff to embrace the new technology. While most of our usage is in office automation and canned software packages (word processing, database management, spreadsheets, etc.), we have also done in-house programming and development when necessary.

Management at Big Thicket has aggressively committed itself to computerization. Yet until recently, the system's growth (user interest, applications, software, and equipment) has been essentially unmanaged and unplanned. We have reached a plateau, however, where we have approached the limits of our Vector Graphic machine resources. (Vector Graphic 5005, with hard disk and three terminals, including a Tektronics graphic terminal.) It is an appropriate time to assess our computer efforts to date, determine our needs for the future, and plan just how to get from here to there. Since the computer world around us is changing so rapidly, anything longer than a two- to three-year plan would be too speculative. Using the Shenandoah model developed by the WASO Office of Information Management, and working closely with the ADP staff in the Southwest Regional Office, we are in the midst of that assessment now. We hope to have produced a draft Information Management Plan for Big Thicket National Preserve by March 1984. This plan will serve as an outline for phased system development and implementation,

and a justification document for additional procurement.

The overriding goal of information management at Big Thicket is to develop and maintain the capacity to process, analyze, and store *in-house* the data and text necessary to manage your own resources. We intend to be a fully functional independent node in the Southwest Regional computer system, with full communications capabilities. Within the Preserve, system management will be centralized in the Superintendent's office with each division or user responsible for the identification and specification of its own application needs. Whenever possible, off-the-shelf software programs will be used in lieu of custom programming.

Unlike most NPS field areas, we have the luxury of being able to look back on a couple of years of computer experience as we develop our information management plan. A few of the more interesting issues to be discussed in the plan may not be obvious to other parks just starting out. They are outlined here, with some of the thoughts that we need to keep in mind as we upgrade:

System management. Our current micro-based system runs itself — or so we thought until the resident expert transferred out and took most of the expertise with him. A well-run system may be able to run itself (for awhile at least) but only if careful planning has gone into standard operating procedures. Some of the many things that need to be considered — even for the smallest installation — include file access and security, disk space management, system backups, and software and equipment maintenance. Procedures need to be identified and *well documented.* Read that sentence again. It is impossible to over-document a computer system.

Staffing. The more sophisticated the computer system, the more management energy that is required. Existing park staff at Big Thicket had much of the expertise that was necessary, but not the time (You may be surprised at how much ADP experience some of those underpaid, overworked rangers have.) Our solution: we have hired a Resource Management Computer Specialist, who devotes almost full time to information management and planning, application development, and system maintenance. We also have converted our most experienced clerk-typist to a Computer Operator, responsible for routine system operation and backup, ordering of supplies, and word processing and file management expertise. You're probably thinking this is extreme, and costly. Yes it is; but the alternatives are more costly. To make a full commitment to computerization and the productivity gains that are possible, you'll need qualified people to run the system.

Training. "The people element" is what dooms most computer system to failures. Computer users need adequate orientation, input, and training in order to feel that they are important elements in the "big picture." They may feel threatened if a terminal is put on their desks with the admonition to "interface." Sometimes, you just have to hold hands; other times let people run! We've found that people get hooked very quickly if they have the proper support and encouragement. The same folks, though, can be terribly frustrated without it. Don't be fooled into thinking that computers or word processors are easy to use. Most of them really are not, and it's up to the system manager to make the difference.

Ergonomics. The word's too new for our dictionary, but in essence it means that people (clerks, rangers, managers) work best when they are comfortable. Don't stop at green CRT screens and detachable keyboards. It's short-sighted to spend thousands of taxpayer dollars without looking at the productivity gains that can be made with improved lighting, firm operators' chairs, and work surfaces at the correct height. It's not much extra money, and it can really help.

The most interesting part of any computer system is the application of the technology to solving the problems of the organization. Office automation has already excited the clerk-typists and administrative staff at Big Thicket, as well as a number of the rangers and managers that find themselves writing memos, environmental assessments, and planning documents . . . not to mention those that prepare budgets. In short, just about everybody wants his own terminal. Our present three are slated to grow to at least five in FY84, and potentially more in future years. Word processing, spreadsheets, and business graphics will be more fully integrated and used by more people.

Resource management applications at Big Thicket, however, are the most exciting on the horizon and provide the stimulus for system growth and development. Three of the most interesting are described here — two that we've developed under the present computer environment, and one that will soon begin with an upgraded system:

Plant List. Big Thicket was set aside to preserve the most diverse flora in the entire NPS system. We have built a simple database of over 2600 records (one for each plant species), each containing 28 descriptive fields. If a researcher or visitor wants to know what are the names of all of the yellow wildflowers that bloom in September and occur in two of the Preserve's units but not in another, we can find out. The trick here was having the information available; but it's the computer tool that makes it accessible.

Data Analysis, Cont'd.

This sounds simple *(the heck it does! — Ed.)* except when dealing with remote sites where environmental, logistical, and shipping factors prevent routine field data transmission by mail.

To reduce data handling and obtain field data on a timely basis for merging, we have replaced the field form with a truly portable microcomputer spread sheet. The unit we use for all remote sites has simple word processing capability allowing complete weekly report generation. Unlike a datalogger it should not be carried out in the rain. But almost any shelter will house it for it needs no external power source. Its standard keyboard and number pad, computer flexibility, and price tag of less than one half the datalogger makes it an attractive alternative. With the built-in modem, weekly transfer of field files across the phone to the lab or office micro files is fairly straight forward.

This solves our problem of timely data transmission, but concern about initial manual data entry remains. Very few research programs yet have fully automated data handling for all aspects of the study. There is an overwhelming urge to delegate the responsibility of data entry. I think this is very risky. Data entry still is best done by the person familiar with the data, and it is best done during the data collection process. With the low cost, efficiency and portability

of microcomputers, data entry by the researcher is often the method of choice.

I now have four micros at work most of the time. All reports and data analyses done by graduate students or research technicians are done on one of these machines. The hardware is fully compatible, allowing easy editing of text files and analyses on machines in different physical locations. Machine time, especially in field stations, is increasing with more installation of solid-state recording instruments. Perhaps most important in the short term has been the improved quality assurance, which is so dependent on timely data transmission from remote research sites. We are taking the easy initial steps in developing a data management system. This is considerably helped by the competitive nature of the micro software market.

But there are caution flags. While hardware is the thing that really seems to be pushed on the consumer, I have always found software, even with a major brand computer, the limiting factor. I'm a user, not a computer buff, so I don't ever expect to be a hot programmer. I think you have to take a hard look at your data analyses and management needs before you can separate limiting factors due to hardware from those due to software. Once done, you might find yourself still typing on an old antique eight-bit processor such as this was composed on.

Stottlemyer is a Research Scientist with the NPS/CPSU at Michigan Technological University.

Big Thicket National Preserve
Hunter's Report

Hunting Permit Number

Number of trips to the Preserve this season _____
Number of Animals taken:
Deer (Buck) _____ Deer (Doe) _____ Squirrels _____
Rabbits _____ Hogs _____

Failure to return this report by March 1 following the hunting season will disqualify you for a permit next year.

For information or assistance call (409) 839-2692.

Big Thicket National Preserve
Hunting Permit

Hunting Permit Number
Only For the
Expires

Leave this copy of the permit on the dashboard of your vehicle so that the permit number can be read from outside the vehicle whenever you are hunting in the Preserve.

You must obtain a copy of the Preserve's regulations and a map of the hunt area for the unit you selected

For information or assistance call (409) 839-2692.

Big Thicket National Preserve
Hunting Permit

Hunting Permit Number
Only For the
Expires

Carry this copy of the permit with you whenever you are hunting in the Preserve.

You must obtain a copy of the Preserve's regulations and a map of the hunt area for the unit you selected.

For information or assistance call (409) 839-2692.

Hunting Permit System. Big Thicket is one of the few NPS areas to allow regulated hunting, and just about the only public hunting area in east Texas. Consequently, demand is high; we have had as many as 6,000 applications for less than 2,800 permits. Last year, we instituted a procedure where applicants fill out a machine-readable form, which can be fed through a direct-input device to build a database without laborious keyboard entry. A simple lottery program selects the permittees. Custom-designed permit forms (which include two copies of the permit and a hunter survey card which must be returned to ensure a place in the next year's lottery) are printed and mailed. The whole package needs to pass through the printer but once, and avoids envelope stuffing entirely! Last year's experimental system will be improved this year by the procurement of our own optical mark reader and a friendlier driver program. With some minor refinements, this program could be adapted in other NPS areas for river trip or campsite permits.

Geogaphic Information System. No longer will computer maps and map analysis be the sole property of the Denver Service Center or the archaeologists at Chaco Canyon! We are on the verge of implementing the first phase of a MOSS (Map Overlay and Statistical System) program in which the major ecological, cultural, and management features of the Preserve and surrounding areas will be digitized. Mapping and map analysis will be done locally utilizing a Tektronics graphics terminal (acquired through GSA surplus) and a small multi-color plotter.

MOSS software is in the public domain, but it requires large CPU and disk space as well as considerable sophistication to implement. Our project is a pilot for the Southwest Region, and we are working closely with regional Natural Resource and ADP staffs (as well as the Fish and Wildlife Service's National Coastal Ecosystems Team, which developed the program) as we take the first steps. Our need for geoprocessing is acute, as we strive to address the cumulative impacts of oil and gas development within the Big Thicket. Fortunately, the largest hurdle — the resource mapping — already has been passed. We will phase in the MOSS project as our budget permits, but we expect to have a working analytical tool up and running for the most critical Preserve units within a year.

The needs and concerns discussed on these pages could be met by a variety of hardware and software combinations. As we develop and implement our Information Management Plan, we have made a real effort to identify needs and not vendors, since it is our requirements and goals that must drive our procurements, rather than the latest technology offered by a particular company. After assessing the options available, we have agreed with the assessment reached in the Southwest Region Computer Management Plan: Data General equipment will best meet our diverse needs, at the lowest cost. The specific configuration has yet to be worked out, but plans are underway to transfer the DG minicomputer now in Santa Fe to Big Thicket, once it has been replaced by the newer system described elsewhere in this issue. Regardless of equipment, however, Big Thicket will continue to serve as the lead area in the region in information management. It's a role we have worked hard to attain, and we look forward to sharing the lessons we learn with other park service areas.

Krumenaker is Resource Management / Computer Specialist at Big Thicket NP.

Tension Headache #84 Users and Computers

By Celia Waker

Without a doubt we exist in a highly technological age. We approve of computerized banking, appreciate word processors, and even admire automated bibliographic searches, to say nothing of our awe for computer games. These are all services provided by computers. We use them with only slight hesitations and with little regard for the design considerations involved in creating accurate, efficient, and useful computer programs for our use.

The "tension headache" begins, however, when we neophytes must become more deeply involved in data processing. Just the vocabulary — baud, bits and bytes, floppies and flippies — could convince a person that two aspirin and going to bed may not be sufficient. Foreseeing a longer stay in data processing, perhaps involved in computerized data management systems, one might with justification fear the debilitating effects of the tension inherent between two perspectives of data processing design:

- humans control computers, determining how and what they are capable of accomplishing; and
- computers, based on their technical restrictions, dictate to humans, structuring how functions will be accomplished and therefore limiting what will be accomplished.

On the one hand, humans create marvelous, intricate programs designed to accomplish thousands of simultaneous banking transactions nationwide. On the other hand, the bank clerk notifies you your address is restricted to 12 characters because "the computer won't allow more."

Theodor H. Nelson candidly discusses the "leetle (sic) white lies about how such-and-such is the computer's fault and not your decision . . . 'The computer won't let us' (means) WE DO NOT CHOOSE TO PROVIDE, IN OUR PROGRAMS AND EQUIPMENT, ANY ALTERNATIVES . . . Now, it is often the case that good and sufficient reason exists for the way things are done. But it is also often the case that companies and the public are inconvenienced, or worse, by decisions the computer people make and then hide with their claim of technical necessity."[1]

Individuals responsible for initiating data management systems must mediate between the needs of the information user and the requirements of the computer system. The goal is to use the powerful capabilities of the computer system (remembering it does have legitimate limitations) to efficiently accomplish a task defined by the user. The following suggestions and examples are intended to be helpful in this process.

Try to determine how immutable a software package is, especially if you are assessing a commercially available, pre-programmed software package. The greater the flexibility offered by the software, the greater the likelihood of meeting the information user's needs — accompanied perhaps by a greater risk of offering too many possibilities and being excessively cumbersome to use.

- can large, system-wide changes be made?
  Example: can the program be initialized on the computer system to accept dates in the format you desire (01/24/84 instead of January 24, 1984), or is that format predetermined and unchangeable?
- as the program is run on the system, does it provide alternatives?
  Example: after entering expenditures in a computerized accounting system can you exit the progam or *must* you proceed to a balance sub-program?
- if the program is purchased, is it "locked up" or can your programmer customize the commercially available program to your needs?
  Example: can you insert a brief description of invoiced items as a customized part of a standard accounting package?
- if the program is purchased, can or will the software development firm from whom you purchased the programs make alterations for you? For what fee? Who retains ownership of the new elements?
  Example: will the company develop a linking program from your "spread sheet" program (where you can do math calculations) to your word processing program (where you can edit)?

Pay special attention to the planning phases of designing how the entire system will function, how components will interact, and what the accomplishments of the system will be and could be in the future.

- has the information user thoroughly planned the functions of the program so mid-stream changes will be less likely?
  Example: will a list of the parks need to be alphabetized, in which case the "key" to each park unit must be the park name, rather than an alphabetic or numeric code?
- what system-wide, basic restrictions apply to this type of programming?
  Example: a new program designs graphic displays of research results. Is the printer capable of producing graphics?
- at what point does making the computer system and the programmers "jump through a hoop," although possible, become inefficient?
  Example: a program will sort park unit information to three levels (region, then unit type, then alphabetized park unit), but a user would like the program altered to go to five levels.

Individuals who mediate between information users and data manipulators (computers) often find themselves "interpreting" the requirements for each involved party. On the one hand, the user may not understand the necessity of abiding by computer system requirements. Perhaps because of an over-estimation of the omnipotence of computers, the user may feel responsible for only the broadest scope of a data management system: the ends, rather than the means. However, the critical argument remains "garbage in, garbage out."

Planning, to a great degree, determines the quality of the results. It behooves the user to protect his or her own interests by carefully defining the information according to the data requirements of the computer system.

On the other hand, the computer and its programmer may specify overly restrictive requirements or not appreciate the informational needs of the user. Computers do have legitimate hardware and software requirements which are either unavoidable or circumvented only with great difficulty. People control the inanimate machine, but there still exists a point beyond which it is unreasonable to expect the system to flex. That point needs to be recognized and appreciated.

The two outlooks comprise a power struggle:
- humans, according to their needs, command computers vs.
- computers, because of technical necessities, overrule user needs.

The two outlooks greatly affect computerized management design and implementation, but they remain continually in conflict. It is not too utopian to propose that the tension produced also can be viewed as a constructive force. The phenomenon of tension in physical structures and even in humans serves useful purposes, and this tension is no different. It prevents the user or the computer from dominating data processing.

The over-all efficiency of a given program is better served by striking an equitable and efficient compromise between user needs and computer requirements. Users may find that the computer capabilities more than compensate for imposed restrictions. The structure the computer insists upon prevents the user's needs from creating inefficient and unreasonable programs. The computer system, on the other hand, may be challenged to increased capabilities by the demands of the user. Without the impetus of the other, neither aspect would be goaded to the quality of which it is capable.

Awareness of the user-computer power struggle should alert data management system designers to potential "tension headaches" in store for them. However, awareness of the problem also affords opportunities to develop creative, efficient, and very useful applications which challenge even our current advanced stage of technological development.

Walker is with the Air and Water Quality Division, NPS, Fort Collins, CO.

[1] Nelson, Theodor H., *Computer Lib*, the distributors, South Bend, Indiana, 1974, p.8. This unusual book is based on the premise that everyone should know about computers and deserves explanations in layman's terms. It deserves status as "required reading."

River Use Model Aids Management of Visitor Flows

By A. H. Underhill

The closure of Glen Canyon Dam in 1963 made white water rafting on the Colorado River through Grand Canyon NP available to almost anyone. River use increased from a few hundred to more than 15,000 annual visitors. In 1982, over 95,000 visitor days were spent on the river. A management plan for use and protection of the river became a necessity.

Forest Service studies of wilderness users indicate that enjoyment of the experience generally is inversely proportional to the number of contacts be-

Visitor Data Facilitates Resource Management

By Laura B. Szwak

During the summer of 1983, a pilot project was conducted in three National Capital Region parks to gain planning information about park visitor composition and activities. Mapping was used to record observable characteristics of visitors and their activities. The pilot project was to develop a procedure for obtaining

tween parties. Robert Lucas of the Forest Service and Mordechai Shechter of the Israel Institute of Technology developed a Wilderness Use Simulation Model, which simulates the main characteristics of wilderness visitor movements and interactions. Various combinations and numbers of visitors, entry points, trip lengths, and arrival times can be entered and the model simulates what occurs. Its output consists of matrices on visual, meeting, and overtaking encounters; tables of data on arrivals and departures; characterstics of user parties; and summary tables on overall levels of encounters on the trail and in camp. This basic model is available on the Forest Service's Univac computer in Fort Collins, Colo.

In October 1981, together with Busa Xaba, University of Arizona graduate student, I undertook modification of this model for river travel through Grand Canyon. A program was written for an Apple microcomputer to create 48 river trips for oar and motor travel, varying in length from 6 to 18 days. With this input data, the model was programmed for the current combination of oar and motor trips being launched weekly during the peak summer season, and a three week simulation was run. The output of numbers of daily encounters, attraction site use and contacts, and campground use was very close to the actual field records.

Is was then possible to change in the model the mix of oars and motors, increase or decrease the number of launches per day and per week, change trip lengths, and measure how these and other modifications affected encounters between parties and the use of various locations.

The real advantage of this kind of computer simulation is the opportunity to experiment with options on the computer, and not on the public or on the resource. A report on this work was published in May 1983 as CPSU/U of A Technical Report No. 11.

Recently the model was used to show that by restructuring the launch schedule so that no trips of the same length were launched on the same day, daily encounters between parties could be significantly reduced while still launching 31 trips a week, the planned number for July 1984. The CPSU is currently participating in a study of the sociological and ecological affects of fluctuating releases from Glen Canyon Dam. Several flow regimes, varying from 2,000 to 32,000 cubic feet per second, are being incorporated into the simulation model. Trips can then be monitored for changing flow speeds, navigability of rapids, availability of campgrounds, and other impacts of fluctuating water levels on the recreation experience.

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statistics for the Statement for Interpretation (SFI) . . . an annual report that requires a listing of visitor use statistics. As a program development tool, the SFI should identify shifting trends in the visiting public and show adjustments in programming response.

The bases created to store data from this project included ENTRANCE and ONSITE. An auxiliary data base housed necessary control information (date, day of the week, observer, weather, time of day). Data in ENTRANCE came from stationing observers at park entrances to record the characteristics of groups as they entered. Variables in the ENTRANCE data base included group size, age composition, ethnicity, gender, mode of entry, HP or the international handicap symbol on the license plate, and state, also from the license. Since a description of activity onsite also was needed, the ONSITE data base repeated the same variables and added activities pursued by the group.

Observers followed a systematic path through the park, recording the visitors by group. Group size varied depending on the mode of entry and activity pursued. Since an axle counter was used to computer visitation, group size by mode of entry confirmed or determined an appropriate multiplier. Group size also was limited by the mode of entry or size of vehicle, so group size was expected to differ onsite. Only observable visitor characteristics and activities were determined through this system. The number of handicapped was expected to be underrepresented, since only observable handicaps could be recorded. Success also depended on training given observers so that similar definitions were used by all.

A WANG word processor was used to analyze the data. Its List Processing function stored and retrieved data on any variable contained in the system and allowed creation of certain subsets of the visitor population, such as "children," "females," or "picnickers." The system could select subset data by four variables in ranges or by specific values, using and/or logic. As an example, one data set contained (1) children who (2) picnic in (3) groups of over 4 persons (4) on Sundays.

Once the population was selected, it could be output to a word processing document so that other statistics, primarily simple mathematical functions, could be applied. The major limitation was selection by only four variables. Processing time also increases with the number of entries.

Major use of the system was to provide a consistent mechanism for recording visitor use information over time and to select and analyze certain subsets of the park population. The use of a WANG is only a mechanical means to achieve this objective. For elaborate data analyses requiring computation of statistics other than percentages, this system is not recommended. It is also not recommended for data bases with more than 5,000 records.

Szwak is with the Recreation Resources Assistance Division, NPS, Dept. of the Interior, Washington, D.C. 20240.

One female, one male, and one dog . . . the "group composition" of one data set in the National Capital Region's pilot project to gain planning information about park visitors.

Visitation Census

In June 1983, the Office of Management and Budget (OMB) approved a survey, entitled Park Visitation Census, for NPS use. The core instrument consists of questions that determine visitors' length of stay, movement patterns within the park, repeat visitation, group size and composition, and activities pursued onsite. An open-ended section allows park managers the opportunity to ask questions about a specific park problem or issue. The survey can be administered as a mailed questionnaire or a personal interview. The OMB authorization for use of the Park Visitation Census expires Dec. 31, 1985. A total of 14 NPS areas nationwide are using this survey instrument.

The Uplands Field Research Lab in the Great Smoky Mountains NP is developing a data analysis software package for the Park Visitation Census instrument. The package will be designed for an IBM Personal Computer. The projected date of completion of the package is fall of 1984.

For a copy of the survey instrument, contact the Recreation Resources Assistance Division, WASO, 1100 L Street, NW, Washington, DC 20240.

CONTACT: Dr. John Peine, Uplands Field Research Lab, Great Smoky Mountains NP, Gatlinburg, Tenn. 37738.

From Washington, D.C.:

Natural Landmarks Information System

The Natural Landmarks Information System is a user-friendly means of maintaining and accessing an automated data base on designated, potential and delisted National Natural Landmarks (NNL's), which are significant examples of geological features and ecological communities. Data storage is by location, status, condition, ownership/management and resource type.

The WASO Interagency Resources Division uses the system to add, update and delete natural landmark records, to prepare reports in response to public request and to carry out analyses to aid management decisions on where to direct program resources from site study and nomination. It is also used to provide information for the annual report to Congress on threatened and damaged Landmarks.

Regional offices use the system to provide information to the public and to companies and agencies with management responsibility, planning, review or implementation activities related to potential or designated sites; and for analysis to assist in program administration. For example, the Pacific Northwest Region has used the data base to provide lists of designated and potential NNL's located on Federal land to each of the Federal land-managing agencies in the Region, to provide reports of designated NNL's by county to a private energy developer locating an oil pipeline, and to share natural landmark information with NPS regional environmental review staff and state heritage program offices for use when commenting on public and private development proposals requiring permits.

The system runs on the NPS Hewlett-Packard 3000 minicomputer. Reports may be obtained by untrained users through a user-friendly menu system. The Hewlett-Packard language, QUERY, may be used to manipulate data and to produce ad hoc reports tailored to specific information requests.

CONTACT: Arthur Stewart, Interagency Resources Division, NPS, Washington, D.C. 20240.

Pest Information Management System

The Biological Resources Division of NPS has developed a Pest Information Management System (PIMS) to satisfy the needs of the Pest Management Program. PIMS resides on a CPT 8525 microprocessing unit utilizing floppy disk storage and a 5 megabyte hard disk. Software accessories include: Compupak, a CP/M programming system; and TTY, an asynchronous communications system. The TTY software enables communication with nearly any remote unit that can use ASCII. Besides other CPT systems, the central CPT unit has communicated successfully with IBM-PC, TRS/Radio Shack, Apple, Hewlett-Packard, and Raytheon/Lexitron processors.

PIMS encompasses three major subsystems: IPM Information, Pesticide Use Tracking, and Management Reports. The IPM Information subsystem provides current, comprehensive, theoretical and practical information for managing pests within the National Park System. When completed, this subsystem will provide up-to-date technical information on the management of 49 pests of concern Servicewide. This in-

formation can be transferred electronically to parks or regions that have CPT compatible equipment. Hard copies of the information also can be generated for units that do not have TTY or CPT compatible equipment.

The Pesticide Use Tracking subsystem is designed to track pesticide use on a park by park basis. It's unique feature is that the Pesticide Use Proposal Form (Form 10-21A) can be transferred electronically to the Region or Washington Office. This subsystem is also the foundation for the Management Reports subsystem, the workhorse of the Pest Information Management System.

The Management Reports subsystem provides summary reports on pesticide use and related topics. The versatility of this subsystem lies in its ability to select information from the Pesticide Use Tracking subsystem based on a group of selection commands that can be used singly or in combination, depending on the information needs of the user. For example, summary reports can be generated for the following categories or combination of categories: pest, active ingredient, type of pest, location of pesticide use, and amount of pesticide used.

CONTACT: Dr. Michael Ruggiero or Gary Johnston, NPS Biological Resources Division (485), Washington, D.C. 20240.

COMMON Data Base Contains Park Basics

In the past there has been no central source of key information about park units that could provide rapid answers to questions asked by decision-makers. The COMMON database has been developed to meet that need. The Office of Information Management is working with each program area to define the set of information they need to make day-to-day as well as policy-level decisions.

The COMMON database contains basic park information such as Superintendent's name, phone number and address, percentages of park area in different land use zones, Clean Air Act status, status of park planning documents, amount of federal and non-federal acreage, park type, NPS region, and State and county location. The database is stored on the NPS Hewlett-Packard 3000 minicomputer in WASO and can be accessed from any terminal, micro, or word/processor with communications capability by using the HP database language, QUERY. Detailed information pertaining to particular program areas will still be stored in separate data bases maintained by various offices on different computers.

The COMMON database is being expanded to include more information about park units. Information about COMMON data items will form the beginning of the Servicewide data dictionary which will include information about all data used in the Service that crosses major organizational and functional lines. The dictionary will not only define the meaning of each piece of data; it will establish who is responsible for its accuracy and currency, where it is generated and stored, and what values it may have.

Some standard QUERY procedures and a Users' Manual will be developed in 1984 by the WASO Office of Information Management.

CONTACT: Kathleen Gundry, NPS Office of Information Management, Department of the Interior. Washington, D.C. 20240.

NPS Microcomputer Software Inventory

The NPS Office of Information Management has conducted an inventory of the uses the Service makes of small computers. The purpose of maintaining the inventory is to let NPS staff know what information in their subject area has been automated, to assist in planning or designing of computer systems, and to help NPS staff exchange ideas and software.

The inventory shows that in the last two to three years, computers have proliferated in the parks, and that park staffs have put them to good use. Over 130 kinds of applications are in the inventory, ranging from visitor and resource management to a wide varity of administrative uses.

The inventory has information on 14 computer systems, 11 of them in parks, which maintain natural resource data. These include systems on marine species and on bears, goats, and other mammals, and systems on ground cover and cave use. There are also four natural resource bibliography systems identified.

Systems in NPS use now run on a variety of kinds of hardware. Commonly used brands include Datapoint, IBM-PC's, Data General, Apples, Vector Graphics, and others. Much of the software is from commercially available "off the shelf" packages. In addition to dBase II, most frequently used are electronic spreadsheet packages such as VISICALC, MULTIPLAN (for Datapoint), and SUPER-CALC. Graphics and statistical packages also are used, and packages such as LOTUS 1-2-3, which integrate some of these functions.

The inventory is available in printed form now and will be made available later in an automated data base. It includes just enough detail to let you know who's doing what kind of business on computers in the parks, and the name and phone number of someone to call to find out more about it.

CONTACT: John Peterson, NPS Office of Information Management (WASO-005), Department of the Interior, Washington, D.C. 20240.

Microcomputers Afford Flexibility

By R. Gerald Wright

The use of large mainframe computer systems linked to dedicated terminals at remote sites is not common in the National Park Service. In part this is because many parks are geographically isolated, semi-autonomous units often connected to low grade telecommunication lines. Another reason is that the resource-oriented educational backgrounds of many NPS personnel have traditionally de-emphasized the use of computers. Finally, there is a managerial suspicion of large, complicated, centralized computer systems.

The advent of low cost, powerful microcomputers is rapidly changing this picture. In recent years, parks have been acquiring a variety of microcomputer systems, either on their own or as part of regional office programs. These computers are being used for several tasks. One application, the management of resource data bases, is discussed below.

As many park personnel are aware, the management of park data bases is an arduous task. Manual compilation, update, and filing of information has long been the norm. The result is that data, particularly

historical data, often are unavailable when needed. In an effort to remedy this situation, several Service-wide resource information systems were established in recent years. These included systems for back-country use data, bear information, threats to the parks and pesticide data. All were tied to a central mainframe computer. The problems in the use and maintenance of these systems reflect, to a large degree, those inherent in any centralized data base. The systems were constructed to include all possible contingencies and, thus, were complex and difficult to alter and update, particularly as they grew in size. It was also hard for individuals using these data bases to verify the accuracy of the data entered.

The result has been that many of the centrally-maintained data bases have been abandoned in favor of systems that keep relevant portions of the data base accessible to the individuals who have the greatest involvement with those parts. As an example, bear information for Glacier NP would be entered and stored on a microcomputer at Glacier. These latter data bases are called distributed systems.

Distributed systems are ideal for organizations that have large numbers of geographically separated units. Each unit, e.g. the park, stores its own data; thus data entry and retrieval time is minimal, and communication problems and costs are significantly reduced. Equally as important, the park assumes the responsibility for accurately updating the data and maintaining its portion of the total data base. The impact of changes in personnel responsible for maintaining a data base is lower in distributed systems for, in the event of disruptions, only a portion of the total data base is affected.

Distributed data bases are typically heirarchically structured, with the most detailed information kept at the local level. Syntheses of these data are made available at higher management levels, e.g., regional offices and WASO. Compatible formats for coding and storing the different data types are necessary for such a system to operate smoothly. Analyses and integration of data sets are easier, and individuals who lack training and experience in indexing information are aided by having a uniform format to follow.

One way to achieve uniformity is to develop common formats for specific data types and distribute them on diskettes compatible with the respective computers to the parks. Where appropriate, existing commercial software, such as MULTIPLAN, could be used for this purpose. In special cases, data specific software may have to be developed internally. For example, the Southeast Regional Office recently developed a museum records cataloging program for parks written in dBase II. The development of a common format and accompanying software for specific data sets could be directed by a Service-wide committee, such as the Natural Resource Information Management Working Group, working in concert with appropriate disciplinary experts.

The rapid proliferation of microcomputers in the NPS undoubtedly will continue to increase. Many parks already are developing their own or adapting commercial software to meet their data management and inventory needs. Efforts to assure compatibility of data storage, at least at the regional level, need to be undertaken quickly, before the problem gets out of hand. Implemented correctly, distributed data bases can be a real aid to the data storage and retrieval needs of the parks and also provide necessary information to other management levels.

Wright is an ecologist with the NPS CPSU at University of Idaho, Moscow.

From DISC . . .

Digital Cartography

Editor's Note: In the Winter '82 issue of Park Science, Fleet first described his program in Digital Cartography. Another article describing a specific application appeared in the Winter '83 issue. Here he gives a brief update.

By Harvey Fleet
Program Manager for Digital Cartography

The Digital Cartography Program at DSC continues to build and analyze digital cartographic data bases. These are line-type (or "vector") data bases and are used for research, environmental analysis, resource management, and planning. Data bases have been contructed for Cape Cod, Upper Delaware, Great Smokies, Yellowstone, Yosemite, Tar Sands Lease Unit (Utah), Prince William Forest, Saratoga, and Capitol Reef. Typically, these data bases include boundaries, landuse/landcover, soils, hydrography, roads, trails, structures, and topography, among many other themes. Most of our data processing is done using SAGIS (Systems Applications Group Information System) on a CDC (Control Data Corporation) CYBER mainframe, on which we timeshare, and which is owned and operated by the Bureau of Reclamation. We supplement our use of the CYBER by making extensive use of our Tektronix 4054 for plotting, analysis, and data display. We routinely produce high-quality color plots of the data the various data bases contain.

Our principal product is a digital data base, rather than specific plots of data in the data base, and we anticipate that our clients will use the data base regularly over the years. Unlike remote sensing, we do not create the thematic maps that we enter into the computer, but concentrate on entering *existing* maps (of any kind of resource feature). The technique is especially suited for faithfully and precisely capturing line-type data (polygons, lines, and points) in digital format.

Recent and upcoming developments include the addition of polygon overlay and a data base manager to our list of analytical tools, the acquisition of an extremely powerful, high resolution color display monitor and complementary ink-jet plotter, publication of the second issue of the Data Base Newsletter, publication of The Manager's Guide to Resource Information Systems, and the capability to merge remote sensing data with our digital cartographic data.

Remote sensing

By Maurice Nyquist, Chief

Since the gift of a modest minicomputer system by NASA/ERL a year ago, the program has been deeply involved with construction of digital data bases for several parks and regions. At three areas (Big Bend, Great Smokies, and Yosemite NPs) high resolution aircraft multispectral scanner (MSS) data are being used in conjunction with digital topographic data. These data bases will be used for park specific natural science, resources management, and fire fuels modeling applications, and in the case of Yosemite, methodology development of Resource-at-Risk determinations for FIREPRO. Other ongoing projects for North Cascades and the National Capital Region are using various combinations of digital topographic.

Landsat MSS, Landsat Thematic Mapper (TM) or high resolution aircraft MSS.

An ambitious program has evolved whereby this office will be developing a digital data base for *all* Alaska parks with preliminary emphasis on vegetation and fire fuel classifications. Funds have been obligated through a cooperative agreement between NOAA, EROS Data Center, NASA, and this office to acquire TM data (30m or ¼-acre pixels) for ≈26 scenes from Landsat D' launched in February 1984. Therefore, TM data for the program will start to become available during the summer of 1984. Digital terrain data for 121 1° X 1° scenes covering the parks have been acquired and processing steps are proceeding.

To carry out the aforementioned projects new modules or other modifications have been made to ELAS (Earth Resources Laboratory Applications Software), the software package we use for multispectral classifiation and geographic information system (GIS) analyses, enabling us to derive elevation, slope, aspect, and average slope length classes; making much easier the lumping of multispectral classes into desired thematic (e.g. vegetation/landcover) classes because the color methodology used retains color meaning and contextual information; and taking the vector data files of SAGIS (the software package used at DSC) to build "line-type" data bases and convert them to ELAS (Earth Resources Lab Applications Software) format.

We look forward to sharing the results of these and other pending developments following testing and actual park applications.

And NPFiora

By Gary S. Waggoner (DSC),
Virginia R. Brueggemann (DSC), and
James P. Bennett (WASO-AWQD)

The NPFLORA program to build and maintain a computerized inventory of the vascular plants occurring in the National Park System has progressed significantly since it was first described in *Park Science* (Spring 1983). At that time, we reported data on 19 parks. As of January 1984 NPFLORA contained data on 45 parks. The data base is currently about 10 megabytes in size, is stored on magnetic tape and costs about $15,000 annually to operate on the Bureau of Reclamation CDC CYBER including data base expansion, querying and maintenance. We are investigating the acquisition of a microcomputer that can provide equivalent capabilities for our purposes in order to avoid these annual charges.

As of January 1984 NPFLORA had an average of 690 taxa per park, of which 87 percent are natives, 11 percent are introduced, and 2 percent are undetermined. the number of parks in the data base has more than doubled, but these percentages have remained virtually stable. It appears that the average number of introduced taxa in the Park System is roughly 11 percent of the total flora occurring.

The NPFLORA printouts have provided park staffs with a target for corrections, deletions, and additions. The result has been a considerable improvement in the overall accuracy and quality of the data base, which was set up originally from sources such as publications. theses . and park listings.

In the Next Issue:

A number of computer articles arrived after the deadline and will be included in future issues as space permits. Part II of the Redwood NP rehab story will cover vegetation, fish and wildlife; a Gateway NRA article will describe an oil spill workshop; from Alaska a story details research into the decline of Denali's caribou herd; an urban soils article from the National Capital Region contains valuable tips for urban park managers; how to balance biological and social research comes from the Ozark National Scenic Riverways, and of course there will be glorious highlights from all Regions.